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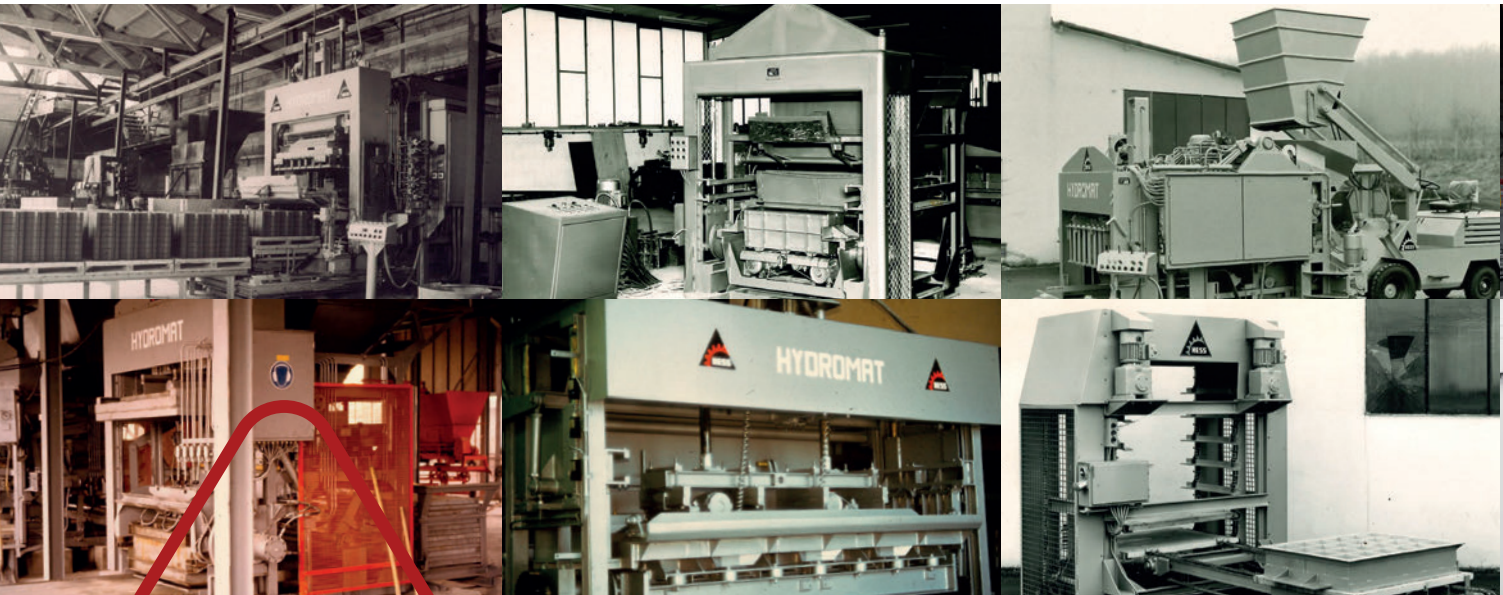
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## Shaping the Future – Middle East's Transformation into Sustainable Epicenters

In a region historically synonymous with oil prosperity, we find ourselves amidst an unprecedented shift, witnessing the emergence of forward-thinking, sustainable urban paradigms. This remarkable transformation is shaping the Middle East into a beacon of innovation, a testament to the power of envisioning and realizing a harmonious coexistence between nature and modernity.

Saudi Arabia, for example, with its ambitious undertakings, is setting the stage for monumental change that resonates worldwide. The Kingdom's mega-projects stand as symbols of inspiration and serve as blueprints for the global community. These initiatives are not just about impressive skylines but also about ushering in an era of sustainability, demonstrating that progress can be achieved without compromising the environment. These colossal endeavors will undoubtedly redefine the realm of urban possibilities.

Dubai, long heralded as a center of transformation, has evolved over the years into a dynamic nexus of tourism and a hub for pivotal global decisions. With accessibility from every corner of the globe, Dubai exemplifies the fusion of modernity and culture, an embodiment of innovation that refuses to rest on laurels. The landmark Expo 2020 catalyzed a seismic shift towards sustainability, galvanizing public consciousness. The ripple effects have been profound, embedding the understanding that the Middle East's destiny is interwoven with a sustainable future.

Our publication has consistently chronicled the Middle East's march towards progress. As we present this latest issue, we invite you to embark on a journey through the pages that reflect the region's dynamic tapestry. These stories are a testament to the region's readiness to embrace the challenges and opportunities of tomorrow. It's a pleasure to share in the excitement, and we extend our gratitude to our readers for joining us in celebrating the remarkable strides that the Middle East has taken towards a greener, more vibrant future.

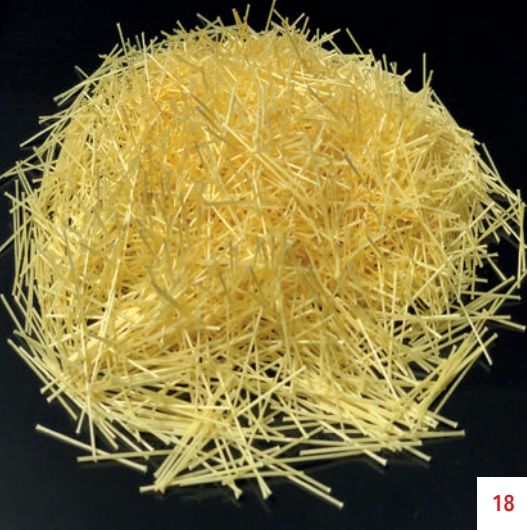
## رسم ملامح المستقبل – تحول الشرق الأوسط إلى مراكز مستدامة

في منطقة ملازمة تاريخياً للازدهار النفطي، نجد أنفسنا في خضم تحول غير مسبق ونشهد ظهور نماذج حضرية مستدامة تقدمية. ويعمل هذا التحول الملحوظ على تحويل الشرق الأوسط إلى منارة للابتكار ودليلاً على قوة وضع التصورات للتعايش المتناغم بين الطبيعة والحداثة وتحقيقه.

تمهد المملكة العربية السعودية، على سبيل المثال، بمشاريعها الطموحة، الطريق لتغيير هائل يتردد صداه في جميع أنحاء العالم. وتمثل المشاريع الضخمة في المملكة رموزاً للإلهام وتعمل كمخططات للمجتمع العالمي. ولا تقتصر هذه المبادرات على الآفاق المبهرة فحسب، بل تتعلق أيضاً بالدخول في عصر الاستدامة، مما يدل على أنه يمكن تحقيق التقدم دون المساس بالبيئة. ولا شك أن هذه المساعي والجهود الهائلة ستعيد تعريف عالم الإمكانيات الحضرية.

لقد تطورت دبي، التي لطالما عرفت بأنها مركز للتحول، على مر السنين وأصبحت تمثل رابطاً ديناميكياً للسياحة ومركزاً للقرارات العالمية المحورية. ويفضل إمكانية الوصول إليها من كل ركن من أركان العالم، تجسد دبي اندماج الحداثة والثقافة، وهي تجسيد للابتكار الذي يرفض التوقف فقط عند أمجاد الماضي. ولقد حفز معرض إكسبو 2020 التاريخي تحولاً جذرياً نحو الاستدامة وإثارة الوعي العام. وكانت التدايعات عميقة ورسخت فهمًا مفاده أن مصير الشرق الأوسط متشابك مع المستقبل المستدام.

لقد أرخت منشوراتنا باستمرار مسيرة الشرق الأوسط نحو التقدم. وبينما نقدم هذا العدد الأخير، ندعوكم للشروع في رحلة عبر الصفحات التي تعكس النسيج الديناميكي للمنطقة. وتمثل هذه القصص دليلاً على استعداد المنطقة وجاهزيتها لتبني تحديات الغد وفرصه. وإنه لمن دواعي سرورنا أن نشارك هذه الإثارة ونعرب عن امتناننا لقرائنا لانضمامهم إلينا في الاحتفال بالخطوات الرائعة التي خطاها الشرق الأوسط نحو مستقبل أكثر خضرة وحيوية.



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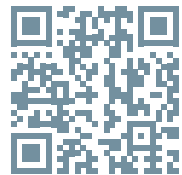
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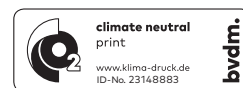
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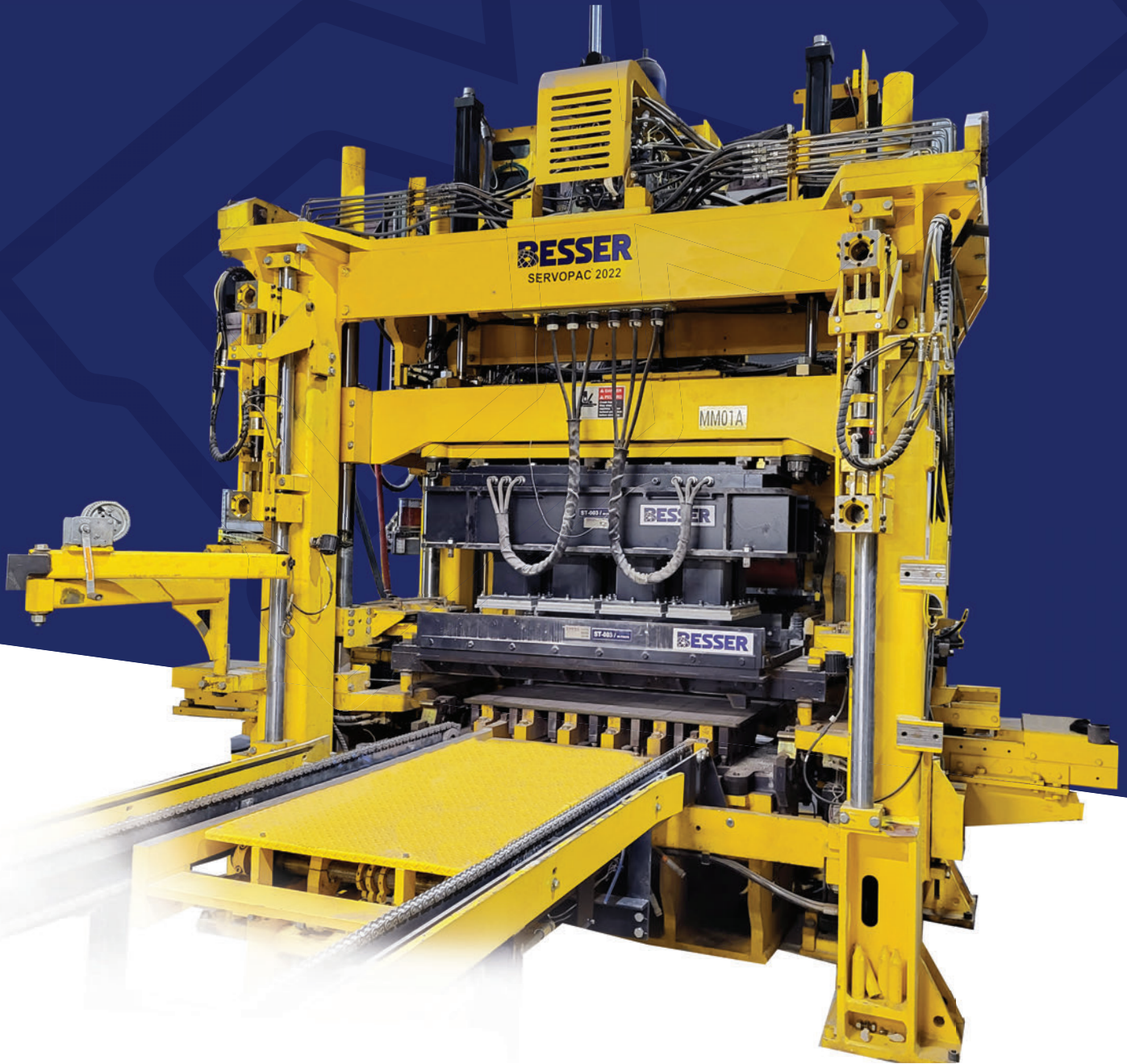
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# Quality control of recycled concrete aggregates using Laser-Induced Breakdown Spectroscopy

## مراقبة جودة الركام الخرساني المُعاد تدويره باستخدام التنظير الطيفي للتحلل المستحث بالليزر

■ Francesco Di Maio, Cheng Chang, Ali Vahidi, Abraham T. Gebremariam and Peter Rem, Resource & Recycling, Department of Engineering Structures, Faculty of Civil Engineering and Geosciences, Delft University of Technology, The Netherlands

The replacement of natural aggregates with recycled aggregates is hampered by the industry's perception that recycled aggregates are highly variable in quality and that the cost and time-lag to ensure the quality of recycled aggregates for high-end applications is prohibitive. There is a need to cost-effectively measure the quality of recycled aggregates and make this information available online to ensure that it meets the industry's requirements. Therefore, innovative recycling technologies that can efficiently identify different contaminant materials play a vital role in upcycling End-of-Life (EoL) concrete and implementing a circular economy.

إن استبدال الركام الطبيعي بالركام المُعاد تدويره أعيق بسبب النظرة السائدة في قطاع الصناعة بأن الركام المُعاد تدويره متغير بدرجة كبيرة من حيث الجودة وأن التكلفة والفارق الزمني لضمان جودة الركام المُعاد تدويره للاستخدامات المتطورة يمثل عائقًا كبيرًا. فهناك حاجة لقياس جودة الركام المُعاد تدويره بتكلفة معقولة وإتاحة هذه المعلومات عبر الإنترنت للتأكد من أنها تلي متطلبات الصناعة. لذلك، تؤدي تقنيات إعادة التدوير المبتكرة التي يمكنها تحديد المواد الملوثة المختلفة بفعالية دورًا حيويًا في إعادة تدوير الخرسانة المتهاكلة (EoL) للأفضل وتطبيق نظام الاقتصاد الدائري.

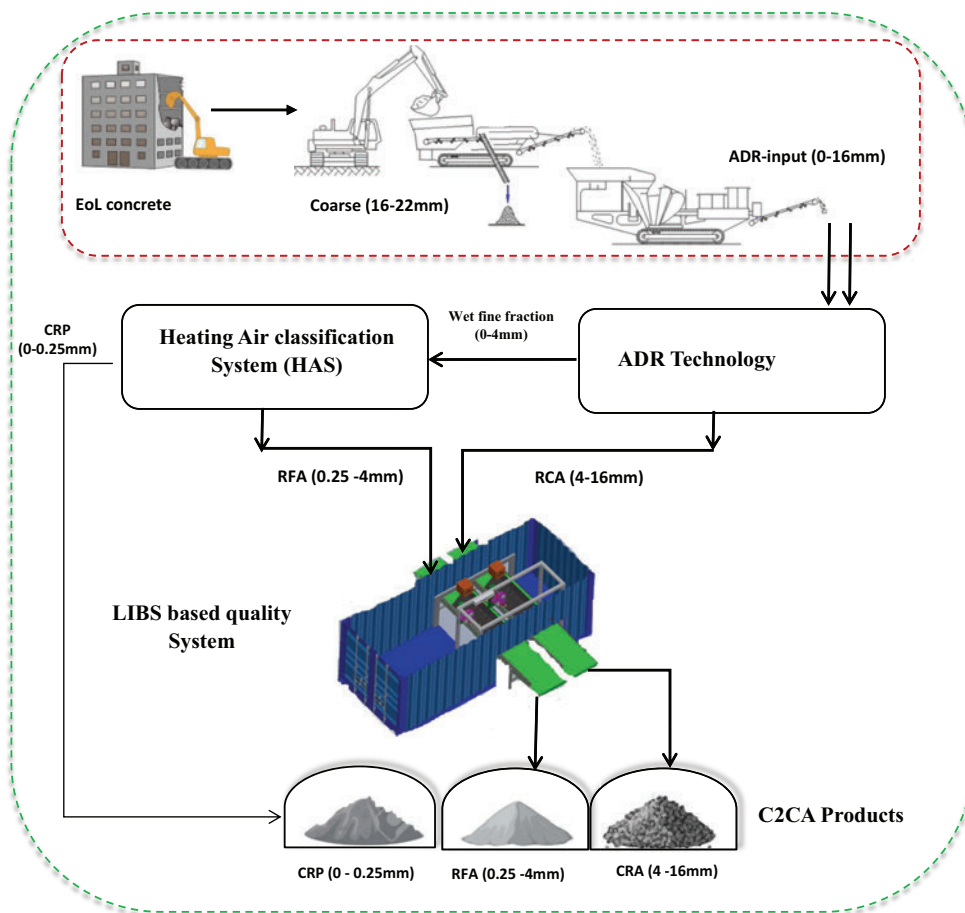


Fig. 1: A sketch of EoL concrete recycling approach based on C2CA technology.



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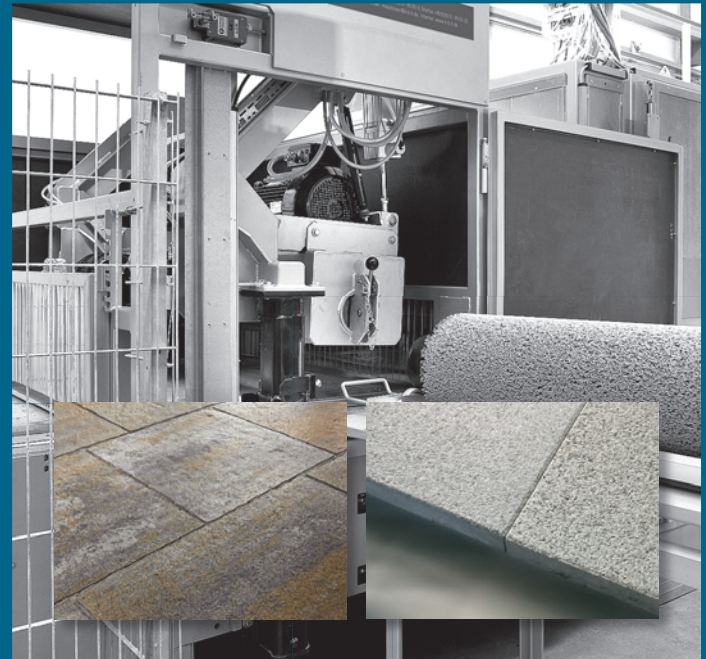
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This article presents the Laser-Induced Breakdown Spectroscopy (LIBS)-based quality system's concept and implementation along with the C2CA concrete recycling facility (Fig. 1). C2CA is a set of technologies that enable the recovery of high quality recycled coarse aggregates (CRA), recycled fine aggregates (FRA) and recycled cement paste-rich powder (CRP) from EoL concrete. One of the advanced technologies C2CA embraces is the LIBS-based quality system which is used to characterize and identify the quality of coarse and fine recycled aggregates through the value chain. This is done by integrating the conveyed information from the LIBS into radio-frequency identification (RFID) tags, where the information about the quality of the recycled aggregate is tracked and accessed securely when needed by all actors involved in the value chain and the stakeholders. Doing so addresses some of the existing barriers to recycling concrete and improves adverse client perceptions of recycled products. By openly displaying the quality of recycled products, it is possible to build trust and accountability throughout the value chain. This is something missing from recycling industries, and here the C2CA approach tries to address some quality-related barriers.

Directly after Advanced Dry Recovery (ADR) and Heating Air classification System (HAS)[1, 2], the 0~4 mm and 4~12 mm recycled aggregates are inspected by the LIBS setup to assess their composition in terms of contaminants and particle size distribution of aggregates. This data will be available for



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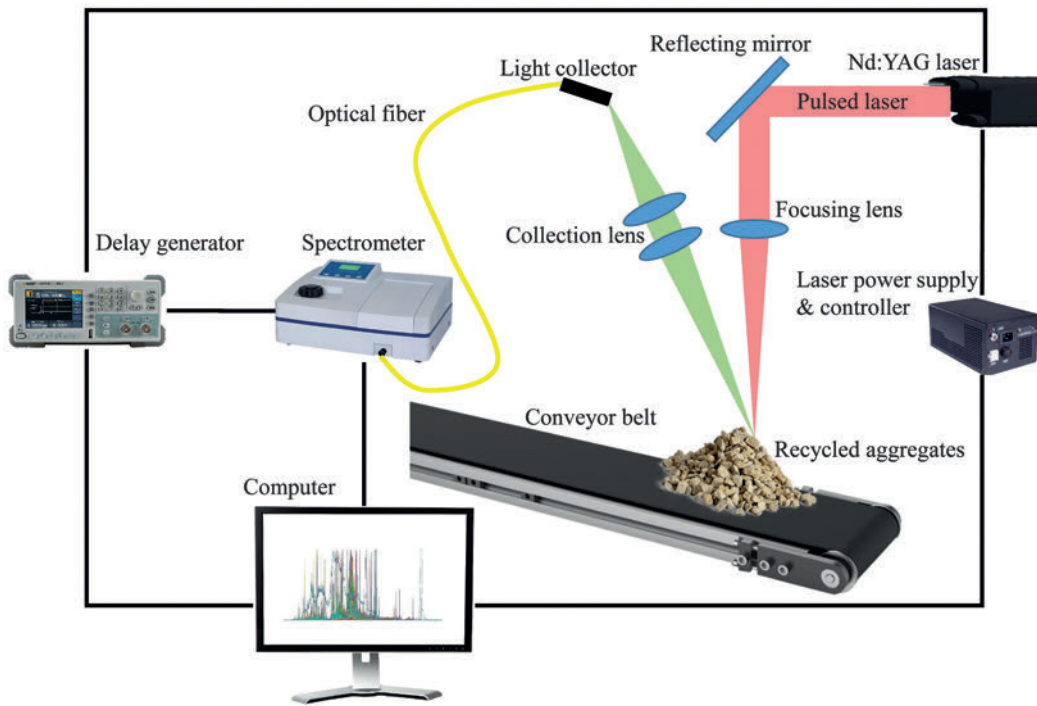


Fig. 2: LIBS system sketch.

clients by scanning RFIDs in the aggregate products. A sketch of the entire process of recycling is shown in Figure 1.

### Experimental setup

The LIBS system consists of a conveyor belt, a compact optical module, and an Nd:YAG nanosecond pulse laser. A typical delay time of 1.5  $\mu$ s after the laser pulse is employed to acquire the spectra to avoid interference from continuous laser-induced plasma radiation. The spectrometer was triggered with a digital delay pulse generator (Quantum Composers). Samples are moved at speeds of 20-100 cm/s (Fig. 2).

In this study, a total of eight potential contaminants are considered as target contaminant material inflows of coarse and fine aggregates resulting from the upcycling of EoL concrete. Such contaminants are bricks, cement paste, foam, glass, gypsum, mineral fibers, plastics, and wood. These contaminants degrade the quality of the aggregates even at low concentrations, so it is essential to identify their presence and measure their concentrations along with the main products of recycling which are recycled coarse aggregates (RCA) and recycled fine aggregates (RFA).

### Chemometric methods

For LIBS quality assessment methods to provide precise outcomes, there are basically two options. Firstly, to take into account that the conditions at which LIBS acquires data change continuously while monitoring raw material/solid waste and correct for these changes. For example, changes may occur in the condition of the surface hit by the laser beam, the angle of incidence, the moisture content, the dust, the distance from the laser focal point, etc. Secondly, to keep the conditions always the same. When LIBS is used to detect production errors in a flow of identical products, the products, and

so the conditions, should always be the same: if they are not, a problem/defect has been detected.

When inspecting raw materials, the conditions are continuously changing because each particle has a different shape and orientation. Therefore, LIBS will respond differently, even if the material is the same. Two ways to deal with such changes are, firstly, to carefully measure all those conditions and apply proper corrections to interpret the spectra's information. Secondly, to adapt the acquisition of individual spectra to the development of the laser-induced plasma: e.g., do not start the acquisition of the spectrum after a fixed delay time with respect to the laser pulse but choose the exact right time to start acquiring the spectra based on the plasma condition.

An efficient method is proposed to identify and classify EoL concrete waste along with RCA and RFA in motion on conveyor belts via laser-induced breakdown spectroscopy (LIBS) coupled with a cluster-based identification algorithm. The algorithm [3] combines principal component analysis (PCA) and chi-square distribution to generate its database for each material from the spectra resulting from the LIBS. Data from the LIBS single-shot spectra (Fig. 4) of EoL samples are applied to train and validate the classification model.

### RFID tags as material passport

Radio Frequency Identification (RFID) technology is a common technology for asset tracking and supply chain management application that can be used in recycled concrete supply chains [4]. The minimum components of an RFID communication system consist of at least one reader, one tag, and antennas to enable energy transmission in voltages on wires and waves in the air [5]. The primary factors to be considered when choosing the right tag for this communication system are the operating frequency, reading range, memory capacity, cost, surface types, and external pressures over the time



*Fig. 3: Representative samples of different waste streams from construction and demolition wastes.*

that tags must withstand. Passive RFID tags are a cost-effective and environmentally friendly tool that could be used as a material passport that can perform adequately over a long time and against external forces (Fig. 5).

After the LIBS analysis, the processed data are linked to the RFID tag with the unique code that is automatically placed into the recycled aggregate flow. This way, any authorized actor or stakeholders of the recycled aggregates value chain

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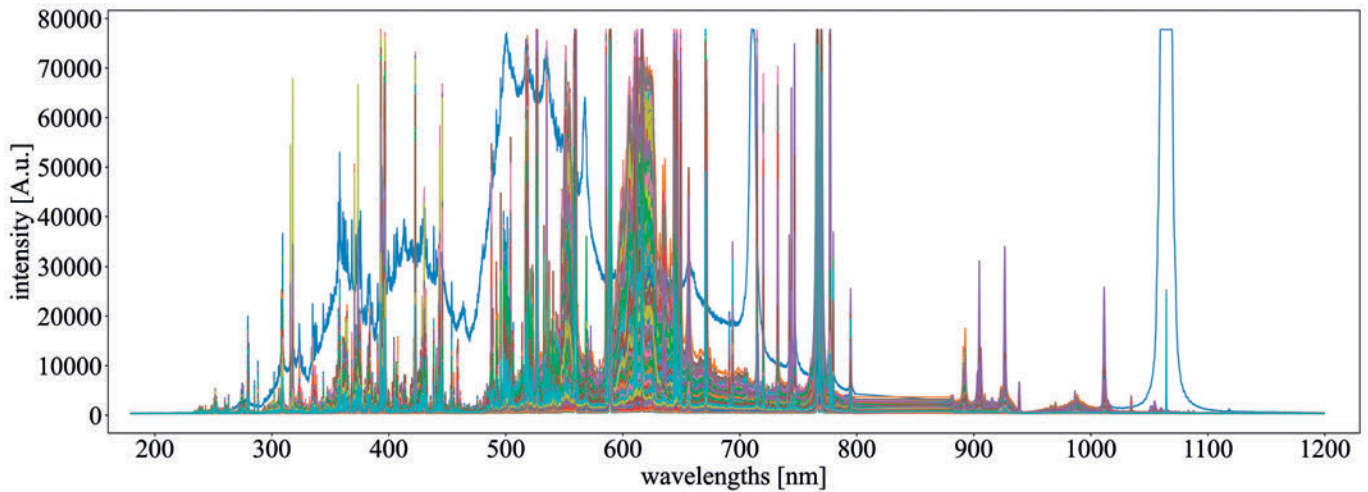


Fig. 4: LIBS raw spectra of bricks.

can read the RFID codes, access the report to choose the application of the material, and ensure the recycled aggregates in terms of the environment and quality. This way, the recycled aggregates will be monitored and sorted by their properties and further linked to an external database as a material bank.

**Conclusions**

The proposed approach is a reliable identification technique based on the LIBS spectral emissions for secondary materials produced from EoL concrete in motion. The model's overall accuracy reached 0.97, according to the results of the validation set classification. This research suggests LIBS may be well suited for fast and in-line analysis of recycled concrete aggregates in industrial applications. This approach presents an innovative approach for the quality characterization of secondary materials produced from EoL concrete being transported on conveyor belts and, therefore, can be of great value for the processing and high-end utilization of EoL concrete. The possibility of linking the data with RFID tags enables transparent communication about the quality of recycled aggregates with stakeholders or clients. Incorporating RFIDs along with the material/product can be used to trace and track all useful information about the product, including its lifespan. Consequently, the transition toward achieving a circular economy is foreseeable. ■

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Fig. 5: Sketch of RFID tags as a material passport.

# Concrete curing system ProCure

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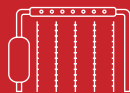
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# Concrete temperature control solutions – a brief insight into the benefits for concrete producers

## حلول التحكم في درجة حرارة الخرسانة – نظرة سريعة على المنافع التي تعود على منتجي الخرسانة

Construction in hot weather countries, especially in the Middle East, poses unique challenges due to high ambient temperatures. One of the critical issues faced during concrete construction is the control of concrete temperature, as excessive heat can negatively impact its strength and durability. Concrete cooling is a proven method to address this challenge in which the choice of the cooling systems can significantly affect construction outcomes. This wrap-up explores the advantages of KTI concrete temperature control solutions, such as water chillers, ice plants, and aggregate coolers for concrete cooling during the mixing process in hot weather regions.

يشكل البناء في البلدان ذات الطقس الحار، وخاصة في الشرق الأوسط، تحديات فريدة من نوعها نظرًا لارتفاع درجات الحرارة المحيطة. وإحدى المشكلات الحساسة التي نواجهها أثناء البناء باستخدام الخرسانة هي التحكم في درجة حرارة الخرسانة، نظرًا لأن الحرارة الزائدة يمكن أن تؤثر سلبًا على قوتها ومتانتها. ويعد تبريد الخرسانة طريقة مجربة لمواجهة هذا التحدي التي يمكن أن يؤثر اختيار أنظمة التبريد فيها بشكل كبير على نتائج البناء. ويستكشف هذا التقرير الختامي مزايا حلول التحكم في درجة حرارة الخرسانة من شركة KTI، مثل مبردات المياه ومصانع الثلج ومبردات الركام لتبريد الخرسانة أثناء عملية الخلط في المناطق ذات الطقس الحار.

### The Importance of Concrete Cooling

Concrete cooling is a crucial production step that involves lowering the temperature of concrete ingredients, water, and aggregates to mitigate the effects of high ambient temperatures on the concrete's setting and curing. High temperatures can accelerate the hydration process, leading to re-

duced workability, increased water demand, and decreased compressive strength. Moreover, elevated temperatures can prompt the rapid formation of ettringite, a compound that may negatively impact the concrete's long-term durability. By cooling the concrete components, construction teams can optimize the concrete's properties, enhance workability, and improve overall construction quality.



*KTI Flake Ice Plant including Ice Water Plant installed next to a concrete batching plant to provide cold water and flake ice directly to the concrete mixer to control its temperature. Flake ice is established since the more than 30 years for this application. However, the production of flake ice can be quite energy intensive.*

## Types of Concrete Cooling Systems in the Middle East

In the Middle East, where extreme heat poses a common challenge, a range of concrete cooling systems are employed to address these conditions. These systems encompass methods such as aggregate silo cooling using cold air, chilled water, and ice cooling. Among these options, a hybrid approach combining ice cooling with a water chiller system emerges as highly effective, especially when integrated with KTI ice plants and chillers. This combination capitalizes on the inherent benefits of energy-efficient cooling methods like aggregate and water cooling, outperforming traditional ice cooling.

While aggregate cooling and water cooling are recognized for their energy efficiency advantages, it's important to acknowledge a potential drawback of aggregate cooling: the necessity for a specific dwell time of aggregates in the silos. This requirement is directly correlated with the size of the silos, which can impact the practicality and efficiency of the cooling process, particularly when working within tight construction schedules.

An integral aspect of KTI's approach is the emphasis on energy efficiency. The company's commitment to sustainability and innovation is evident in how their plants are designed and ordered. KTI prioritizes energy efficiency when crafting their cooling solutions, ensuring that their technologies align with both construction industry demands and environmental considerations. This approach not only underscores KTI's dedication to providing cutting-edge solutions but also showcases their contribution to a more sustainable future for construction practices in challenging climates.

## Benefits through KTI Concrete Cooling Solutions

### Sustainability

KTI equipment is designed with sustainability in mind. The system utilizes environmentally friendly refrigerants, such as ammonia, instead of harmful fluorocarbon-based gases. This choice ensures minimal harm to the ozone layer and significantly reduced greenhouse gas emissions. As sustainability becomes a pressing concern in construction, KTI's commitment to eco-friendly practices, with the use of ammonia as a refrigeration gas, makes their ice cooling system a preferred choice for environmentally conscious projects.

### Low Energy Consumption

KTI solutions boast exceptional energy efficiency, offering substantial energy savings compared to other cooling systems available in the market. With their advanced technology and optimized design, these systems significantly reduce energy consumption during the cooling process, making them a cost-effective solution for long-term projects. Notably, KTI provides Plate Ice Plants that go a step further, achieving more than 40% energy savings compared to conventional ice plants. This impressive energy efficiency further solidifies KTI's position as a leading choice for sustainable and economical concrete cooling solutions.

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## The Pemat Experience





The batching plant is equipped with a KTI Plate Ice Plant and a KTI Ice Water Plant. The production of plate ice has been established over the past years with this state-of-the-art technology, that is up 45% more energy efficient compared to the production of flake ice. The concrete mixing time or property is proved to be not affected and therefore plate ice brings only advantages to the concrete producers.

### Stability

In hot weather conditions, consistent concrete quality can be challenging to achieve. However, KTI equipment stands out in providing a stable and reliable cooling solution that ensures a constant supply of temperature-controlled concrete. This stability is a result of KTI's dedication to utilizing high technology and employing very high-quality materials, which contributes to their exceptional performance. The uniform concrete temperatures achieved through this advanced approach enhance workability and enable construction teams to maintain a consistent level of quality throughout the project.

### Durability

Durability is paramount in construction, particularly in regions with harsh climates. KTI products are engineered to withstand demanding environmental conditions and extended operational hours. One of the key reasons contributing to their exceptional durability is the containerized design of the plant, which isolates it completely from the surrounding temperature and dust. This design feature ensures the inner components are kept safe and protected, further enhancing the longevity of the system. Their robust construction, combined with the use of high-quality materials and containerized design, ensures a long service life and minimal maintenance requirements, making it a durable and cost-effective investment for concrete precooling projects in challenging environments.



An aggregate cooling system is installed next to inline bins to pre-cool the coarse aggregates using cold air. Due to the large mass-fraction of aggregates in the concrete mix, the impact of lowering its temperature is massive on the concrete mixing temperature. Beside the implementation of water chillers and ice plants for concrete cooling, the installation of such an efficient aggregate cooling system can reduce the requirement of ice.

### Conclusion

In hot weather countries like the Middle East, concrete pre-cooling is essential to ensure construction quality and durability. Among the various precooling systems available, KTI concrete temperature control equipment offers distinct advantages. Their focus on sustainability, low energy consumption, stability, and durability makes them an ideal choice for concrete precooling projects in challenging environments. By opting for KTI's advanced cooling systems, construction teams can significantly improve project outcomes and achieve superior concrete performance. ■

#### FURTHER INFORMATION



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# Quality and performance of polyvinyl alcohol fibers for durable constructions

## جودة ألياف البولي فينيل الكحولي وأدائها للإنشاءات المتينة

Kuraray is a Japanese chemical company, founded in 1926 as a Rayon manufacturer, and now operates globally. Kuraray offers innovative, sustainable and cutting-edge technology for numerous industries such as construction, automotive, packaging, agriculture and consumer goods all over the world. Kuralon is a synthetic fiber which is made from Polyvinyl Alcohol (PVA) resin. In 1950, Kuraray started its commercial production of Kuralon, which was the first synthetic fiber invented in Japan, and it has an especially long history in the cement composite market as a substitute of asbestos.

Kuraray هي شركة كيمائيات يابانية، تأسست عام 1926 كشركة مصنعة للحرير الاصطناعي "الرايون"، وتعمل الآن على مستوى العالم. وتقدم شركة Kuraray تكنولوجيا مبتكرة ومستدامة ومتطورة للعديد من الصناعات مثل البناء والسيارات والتعبئة والتغليف والزراعة والسلع الاستهلاكية في جميع أنحاء العالم. والكورالون عبارة عن ألياف صناعية مصنوعة من راتنج البولي فينيل الكحولي (PVA). وفي عام 1950، بدأت شركة Kuraray إنتاجها التجاري للكورالون، وهو أول ألياف صناعية تُختَرَع في اليابان، ولها تاريخ حافل عريق بشكل خاص في سوق الأسمنت المُركَّب كبديل للحرير الصخري "الأسبستوس".

High strength, UV and alkali resistance make Kuralon an ideal material for durable and low maintenance concrete structures. Kuralon offers a unique combination of properties making it most suitable for concrete and mortar reinforcement:

- High Strength
- High Modulus
- Low Elongation
- Good adhesion to Cement Matrix
- Alkaline Resistance
- UV Resistance
- Light Weight
- No Corrosion

### The benefits of using PVA fiber for preventing the crucial deterioration of concrete structures

In conventional steel reinforced concrete a deflection of 4 mm at the top of a specimen causes a crack opening at the specimen's bottom side of about 100 µm (specimen size; 100x100x350 mm). This is a critical value as capillary suction of a concrete surface starts to show a serious increase when its cracks exceed a width of 100 µm. The critical point is the very early post crack period. As soon as the first crack appears, moisture penetrates the specimen and causes long-term damage. It is therefore essential to control the crack as soon as it occurs. PVA fibers are predestined to actively control the early post crack period when it is most needed.

Kuraray's PVA fiber, Kuralon, bridges and keeps the cracks very small – especially in the most important phase right after



Kuralon RF4000x30 mm

the crack. The advantage is that the probability of critical deterioration of the concrete structure is minimized. Sometimes this even helps self-healing. This performance would be worth considering if one desires to reinforce concrete structures under severe conditions such as high erosion risk from sea waves, drifting objects in offshore use, and high risks of structural deterioration by heavy dynamic load and anti-freeze chemicals on highways and airport taxiways.

Kuralon reinforced concrete strain hardens after first cracking and demonstrates a strain capacity 500 times greater than normal concrete. That ensures superior fracture toughness, damage tolerance and ductility under severe shear loading conditions. Kuralon helps to extend service life and drives sustainable investment decisions. [1]

Similar research and evaluations are conducted by Kuraray's clients since this technology contributes to long-life sustainable construction with cost efficiency in long term.

**Main application fields**

The technology can be used for production of SHCC (Strain-Hardening Cementitious Composite) for road construction and 3D concrete printing.

Sustainability of infrastructure requires advanced materials. Kuraray's Kuralon micro PVA fibers enhance the functional performance of engineered cementitious composites (ECC) and extend service life. Bridge decks made with Kuralon reinforced ECC joint can have significant advantages in environmental and cost performance: 40% less life cycle energy consumption, 38% less raw material consumption, 39% less carbon dioxide and 50% less solid waste generation than bridge decks with steel expansion joint. [2]

3D printing has reached new dimensions and is setting new standards for the construction industry. 3D printed buildings enable innovative design, accelerate delivery and produce less construction waste. Kuraray's Kuralon is an ideal reinforcing fiber for SHCC used in 3D concrete printing.

UHPFRC stands for Ultra-High Performance Fiber Reinforced Concrete for envelopes and decorative esthetics like fine-decorative and cladding façade, solar shading, etc. Kuralon meso fiber is an ideal synthetic fiber to reinforce UHPFRC, and provides the following benefits to clients:

- Thin and lightweight with fine decorations and durability are available
- Rusty water doesn't come to the surface of construction materials

Formulations of UHPFRC with Kuralon meso fiber make it adaptable to a wide range of production techniques including shotcrete, traditional casting, 3D concrete printing.

LWAC stands for Lightweight Aggregate Concrete for non-structural use to form a level and more stable surface on which further works can be more readily undertaken, e.g. an inhibitory effect against erosion of substructure in offshore use such as a concrete support structure for offshore wind turbines.

If some inherent weaknesses of LWAC such as brittleness and low elasticity-modulus are improved, the floating LWAC support structure will be the best option. Kuralon macro PVA fiber can reinforce it and improve its performance.



*Life Cycle assessment of bridge decks: Advantages of PVA-FRC over conventional systems [2] (Possible application)*

By introducing Kuralon as a reinforcement of LWAC, the brittle failure resulting from the punching shear is improved, and the punching shear toughness will exceed conventional normal concrete. [3] Moreover, some research groups reported that Kuralon improves the fatigue resistance of LWAC against dynamic cyclic load, and shows approximately 11 times greater fatigue resistance than conventional reinforced concrete. [4]

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**FURTHER INFORMATION**



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# Precise control of concrete processing times thanks to new superplasticiser series

## التحكم الدقيق في أوقات معالجة الخرسانة بفضل سلسلة الملدّنات الفائقة الجديدة

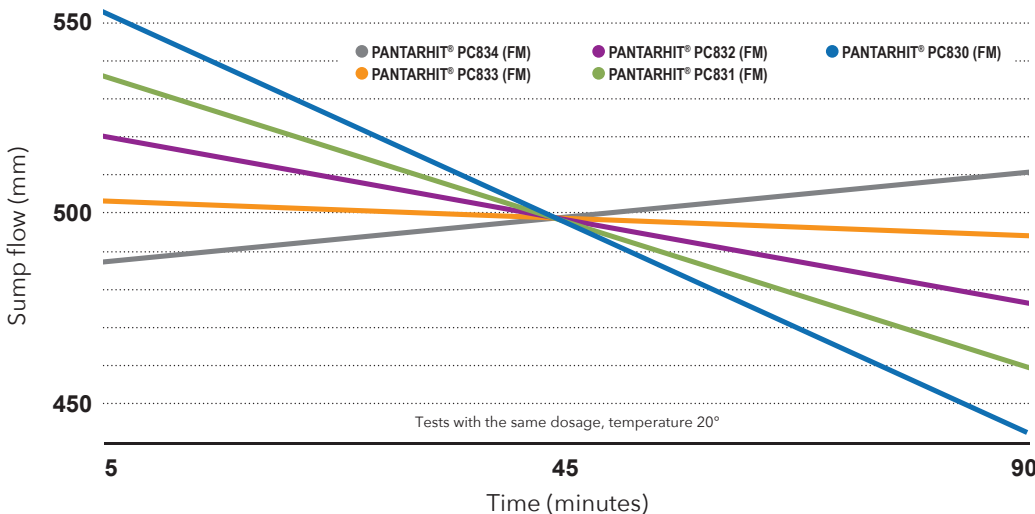
Concrete is a material whose properties must conform to certain general conditions during processing. Fresh concrete curing times have a significant influence on the entire process, especially when producing precast concrete elements. This is where Ha-Be Betonchemie comes in with its specially developed solution for controlling processing times precisely. The Pantarhit® PC83X superplasticiser series enables users to precision plan processing times according to individual needs - and thus also increase efficiency and effectiveness throughout their entire concrete processing operations.

الخرسانة عبارة عن مادة يجب أن تتوافق خواصها مع بعض الشروط العامة أثناء عملية المعالجة. وتتميز أوقات معالجة الخرسانة الخالصة بتأثير كبير على العملية بأكملها، خاصة عند إنتاج عناصر الخرسانة الجاهزة. وهذه تمثل المرحلة التي تُقدّم فيها شركة Ha-Be Betonchemie حلها المطور خصيصًا للتحكم في أوقات المعالجة بدقة. تتيج سلسلة الملدّنات الفائقة Pantarhit® PC83X للمستخدمين التخطيط الدقيق لأوقات المعالجة وفقًا لاحتياجاتهم الفردية - وبالتالي زيادة الكفاءة والفعالية خلال عمليات معالجة الخرسانة بالكامل.

Processing concrete poses a number of challenges. The material can harden too quickly or take too long to set. Processes are slowed down; downtimes occur; the product can exhibit quality deficiencies and, in case of doubt, become unusable. As an established company with sound expertise in concrete chemistry, Ha-Be knows these challenges and has developed a targeted solution: the new Pantarhit PC83X superplasticiser series.

### Fine-tuning in processing

The new Pantarhit PC83X superplasticiser series is made up of Ha-Be products PC830, PC831, PC832, PC833 and PC834, each of which is designed to maintain a specific, precise concrete consistency according to different requirements. Depending on the task, ambient temperature and individual work planning, the PC83X series provides users with a kind of modular system for manufacturing concrete.



Pantarhit PC83X  
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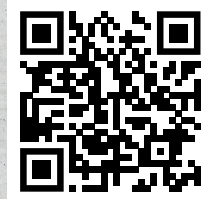
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If, for example, a longer processing time is to be achieved during hot outdoor temperatures, users can move up in the product range. Pantarhit PC834 (FM) is the superplasticiser with the greatest workability retention, whilst Pantarhit PC830 (FM) facilitates the highest early strength development. The gradations within the PC83X series allow consistencies to be fine-tuned to bring maximum efficiency and effectiveness to manufacturing.

**Using superplasticisers for efficient production processes**

Pantarhit PC83X products achieve high early strength in concrete even at low temperatures and without additional heat treatment. Processing cycles can be shortened and significantly faster cycle times can be attained through reloading moulds and formwork more rapidly. In addition to cost savings and increased effectiveness, early strength contributes to a better energy footprint and increased sustainability.

Last but not least, manufacturers can improve product quality with Pantarhit PC83X superplasticisers. Their innovative superplasticiser technology allows concrete to be compacted extremely well. It facilitates manufacturing concretes with a closed, low-porosity surface and homogeneous finish, thereby not just affecting their visual appearance positively, but also enhancing the construction material's quality and durability. ■

**FURTHER INFORMATION**



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# Wet Pressed Concrete Products Gain Popularity Worldwide

## منتجات الخرسانة المضغوطة الرطبة تكتسب شعبية في جميع أنحاء العالم

Due to the exceptional quality of the finished product, modern and developing markets frequently use the wet cast process for making kerbstones and paving slabs. The alternative to wet casting involves many molds, considerable manpower, a large production area, and variable quality end results. In contrast, a wet press installation requires 1 or 3 molds (depending on the press model), only 3 or 4 workers, and a small compact production area yet still produces high-quality products that meet or exceed any national standards.

نظرًا للجودة الاستثنائية للمنتجات النهائية تامة الصنع، تستخدم الأسواق الحديثة والنامية كثيرًا عملية الصب الرطب لصنع أحجار وبلاط الأرصفة. تتضمن العملية البديلة لعملية الصب الرطب العديد من القوالب، وقوة بشرية عاملة كبيرة، ومنطقة إنتاج ضخمة، ونتائج نهائية متغيرة الجودة. وعلى النقيض من ذلك، يتطلب التركيب بالضغط الرطب قالبًا واحدًا أو 3 قوالب (حسب نموذج الضغط)، و3 أو 4 عمال فقط، ومنطقة إنتاج محكمة صغيرة ومع ذلك، فإنها تنتج منتجات عالية الجودة تلبى أي معايير وطنية أو تتجاوزها.

### Products

Columbia Wil El Mil, a world leader in Wet Press technology, offers complete plant solutions including Mix and Batching, Press Machines, Robotic Take off, and stacking. From Kerbstones, Tactile Paving, and Paving Slabs, to Wall Caps, many products and colors can be produced with a wet press process.

The wet pressing process involves filling a mold with wet concrete and then compacting it under extremely high pressure without any vibration. During compaction, the excess water is removed through filters and a vacuum system resulting in a product with superior strength and finish. The concept is simple but for a successful installation, it is necessary to understand the process technology and mix design requirements.



*Kerbstone Production*





Single Station Press with Auto T.O.

This is where the in-depth experience of Columbia Wil El Mil is so important.

The most popular wet presses have a max power of 400 tons and can either have a single mold or three molds, producing the same products. The single mold slides between the press and the fill/eject position whereas the three molds are on a rotating table. The three molds allow filling, pressing, and ejection to happen simultaneously to increase production. Automatic concrete dosing systems fill the mold to achieve consistent and accurate product thicknesses.

After pressing, the product is immediately ejected from the mold and transferred to the pallet by the Take-Off Unit for curing. The Take-Off Unit can be fully automatic with an empty pallet feeder or a simple unit with manual controls. The Columbia Wil El Mil Auto Take Off's uniquely feature electric programmable drives for reduced energy consumption, reduced maintenance, and total flexibility of operation. All the Columbia Wil El Mil machines are optimized for operation in hot climates, with de-rated motors, increased hydraulic oil capacity, and uprated filtration.

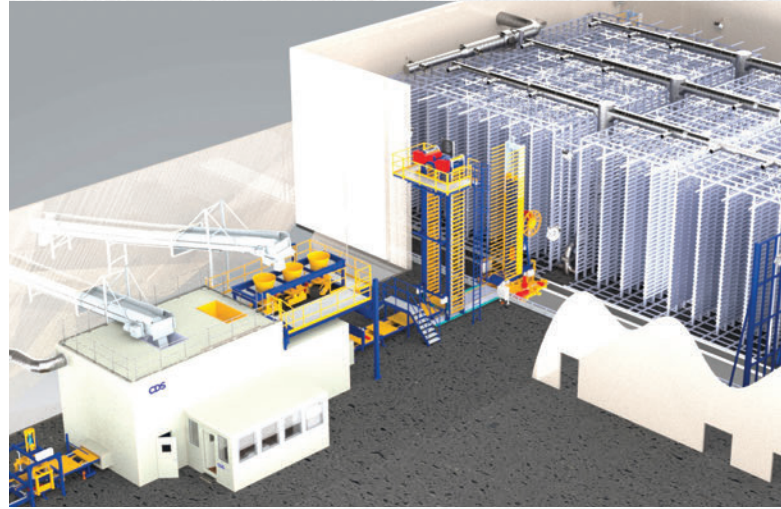
All wet press molds are designed and manufactured in-house at Columbia Wil El Mil and include both standard and custom designs. Columbia Wil El Mil has a strong priority of putting the customer first and providing class-leading equipment and support. Thanks to Columbia Machine, Inc.'s worldwide network of sales and service, Columbia Wil El Mil can effectively support wet press production plants in markets around the world and offer a product range to include turnkey packages.

FURTHER INFORMATION



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# Secondary Processing at Fujairah Concrete Products

## المعالجة الثانوية لدى شركة الفجيرة للمنتجات الخرسانية

Fujairah Concrete products (FCP) - a group company of Fujairah Building Industries situated in Fujairah, UAE - has been a leading producer of high-quality pavers since 1978. Since its establishment the company - which is also the first EPD certified concrete products manufacture in the Middle East - has been committed to providing durable, stylish pavers that enhance outdoor spaces while minimizing their impact on the environment. With a focus on innovation and customer satisfaction, FCP has become a trusted name in the concrete product industry.

شركة الفجيرة للمنتجات الخرسانية - (FCP) إحدى شركات مجموعة الفجيرة لصناعات البناء التي يقع مقرها في الفجيرة، الإمارات العربية المتحدة - تعتبر شركة منتجة رائدة لألآت رصف الطرق عالية الجودة منذ عام 1978. وتلتزم الشركة منذ تأسيسها - وهي أيضاً أول شركة لتصنيع المنتجات الخرسانية المعتمدة من بيان المنتجات البيئية (EPD) في الشرق الأوسط - بتوفير آلات رصف متينة وأنيقة تعمل على تحسين المساحات الخارجية مع تقليل تأثيرها على البيئة. وبفضل تركيزها على الابتكار ورضا العملاء، أصبحت شركة FCP اسماً موثقاً به في صناعة المنتجات الخرسانية.

Its dedication to sustainability, quality and customer service has earned it a loyal customer base and a reputation among other manufacturers. As FCP continues to grow and evolve, it remains committed to its core values, ensuring its products and practices are both environmentally responsible and of very high quality.

KBH Maschinenbau is a German equipment manufacturer, which has been collaborating with FCP in designing unique and sustainable products since 2015. The latest result of this cooperation is the induction of a 'Texturing Line'. This secondary processing line will bring in new levels of efficiency to the texturing process of interlock pavers, flags, kerbstones and step blocks.

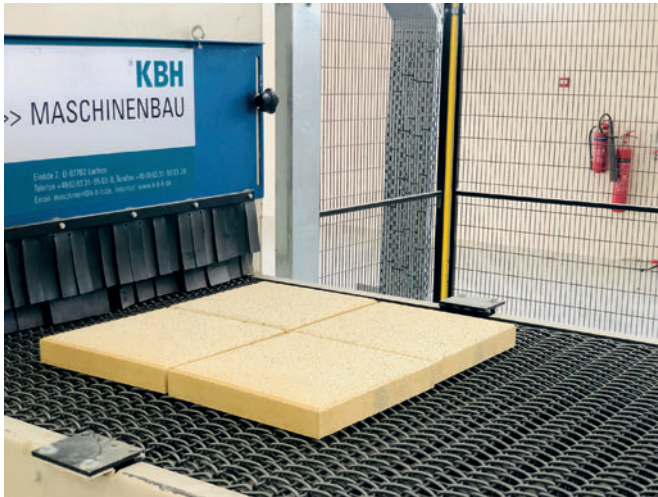
KBH, known for its innovative technology, is using variable speed turbine wheels to blast stainless steel shots to develop

aesthetically appealing surface textures. These machines will enable FCP to launch a wide product range such as pavers, slabs (flag stones) and kerbstones, environmentally friendly and under lowest operational costs. The installation of the texturing machines is a significant investment for FCP, improving the position of the company in the concrete products industry of the Middle East.

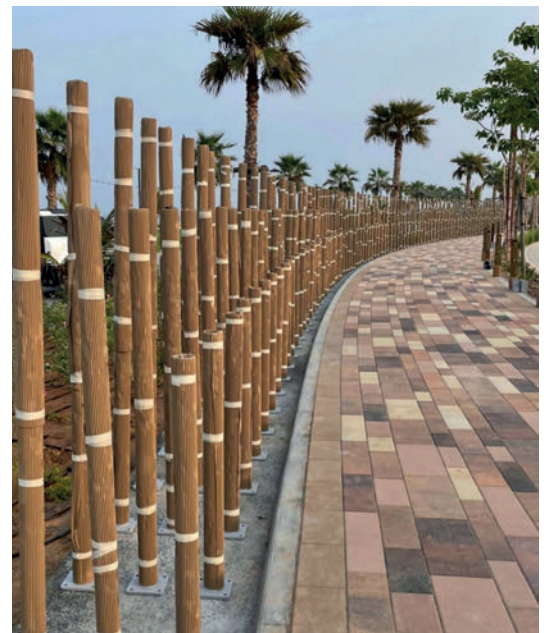
FBI Team: "KBH Maschinenbau provides its customers excellent customer support. Its team of experts has installed the machine and provided training for FCP's staff and offers on-going maintenance and support. Above all KBH is a manufacturer of high-quality architectural landscape products in Germany and the product support provides its customers a head start with the knowledge acquired over the years of production.



The new KBH machines will enable FCP to launch a wide product range.



KBH, known for its innovative technology, is using variable speed turbine wheels to blast stainless steel shots to develop aesthetically appealing surface textures.



The 'Texturing Line' is composed of:

- Cubers loading virgin product and offloading processed product layers.
- State-of-the-art shot blast machine in conjunction with a 3-station curling line. Product layers will not be consolidated in neither the shot blaster nor the curling system. This allows for smaller equipment foot print and ease of equipment supervision and highest plant flexibility, i.e. curling of kerbstones. The line can easily be upgraded to allow for a fully automated sealing line, without major disruption.

Overall KBH machines are an exciting addition to FCP's secondary production process. The company's investment in this technology is sure to pay off, positioning FCP as a unique alternative to other manufacturers. ■

FURTHER INFORMATION



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# Stand-alone and fully automated finishing line in Saudi Arabia

## خط تشطيب مستقل وآلي بالكامل في المملكة العربية السعودية

SR Schindler is a member of the Topwerk Group, a worldwide leader for integrated solutions and convincing expertise in process engineering for the concrete industry. On October 2021 SR Schindler entered into a contract with Sail Alriyada Saudi Industrial Company, called Siefco, for the supply of a manual stand-alone shotblasting - curling line for pavers. Besides SR Schindler's well-known technical know-how, another particularly important point for Siefco's decision was Topwerk's Middle East branch office in Dubai, UAE. Here Topwerk provides regional service, spare parts on stock, and Aftersales for the complete group. A fast help "in case of" is guaranteed and ensures the consistently high productivity of SR Schindler machines.

تعد شركة SR Schindler عضواً بمجموعة شركات Topwerk Group، الشركة الرائدة عالمياً للحلول المتكاملة والتي تتمتع بخبرة مقنعة في مجال هندسة العمليات لمجال صناعة الخرسانة. في شهر أكتوبر من عام 2021، أبرمت شركة SR Schindler عقداً مع شركة سبيل الريادة الصناعية السعودية، المسماة بشركة Siefco، لتوفير خط سفح بالخردق ولف حواف يدوي مستقل لآلات رصف الطرق. بالإضافة إلى المعرفة الفنية ذائعة الصيت التي تحظى بها شركة SR Schindler، فقد كانت النقطة الأخرى بالغة الأهمية وراء قرار Siefco تتمثل في افتتاح مكتب فرع Topwerk في الشرق الأوسط في دبي، الإمارات العربية المتحدة. هنا، تقدم Topwerk الخدمة الإقليمية، وقطع الغيار من المخزون، وخدمات ما بعد البيع للمجموعة الكاملة. وتعتبر المساعدة السريعة "في الأمور العاجلة" مضمونة وتضمن الإنتاجية العالية باستمرار لآلات SR Schindler.

In the project run, Siefco decided to enhance the order by adding automatic loading and unloading devices due to rising production demand. With this addition, Siefco is able to increase the cycle time, which means higher productivity and a decrease of the number of operators due to the now full automatization. This was possible as SR Schindler is quite flexible and delivers tailor-made solutions based on SR Schindler's well-known standard machines. So, for this project, the layout was designed with the idea in mind that some - which

are still strictly confidential - value-adding machines could be easily added to get a seamless integration with the existing line and, at the same time, the consistently high output.

For maximum output, the line was designed for a working width of 1,200 mm, so product layers up to 1,200 x 1,200 mm can be processed. The products are transported by stapled layers on wooden pallets to the de-stacking position. To be as flexible as possible, the line was designed to use three different types of wooden transport pallets.



Cuber infeed



Safety area cuber infeed



Empty pallet magazine

The layer de-stacker is equipped with one traveling trolley driven by a servo motor and a rotating 4-sided clamp. The single layers are moved by a layer pusher that transports the layer onto the conveyor of the shot blasting machine. The emptied transport pallets get stored in a magazine, and the staple can be easily discharged by a forklift (Capacity 15 pallets).

### Shotblasting-curling Line

In the shotblaster, fine cement particles are removed from the surface of the concrete products, thus partially exposing stylistic aggregate, such as granite inclusions. Shotblasted surfaces are characterized by high visual and tactile quality and slip resistance.

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*Shotblaster with layer pusher*

In the shotblasting machine, steel or stainless steel balls with a diameter from 0.6mm to 0.8mm are hurled onto the product surfaces by special turbines. SR Schindler provides one of the strongest shot blasting turbines with enhanced power control in the market, therefore Siefco is able to produce the products their customer demands. The products that need to be shotblasted are placed on a perforated conveyor belt during processing and are cleaned with the help of a blow-off station after the shotblasting process. The abrasive falls through the perforated belt, gets collected, cleaned, and fed back into the process. Any dust generated during processing is extracted by a filter device mounted on the machine.

At the output of the shotblast machine, the individual layers are assembled by means of a layer pusher into a continuous row and further processed in the following curling machine.



*Curling machine with operation panel*

The curling process removes any excess cement from the product surface. The grain in the surface is polished by the electrically height-adjustable and frequency-controlled curling brushes rotating around the horizontal axis. Curling is particularly suitable for structured surfaces because the structure is retained, and the flexible bristles allow processing in deeper areas. Due to the unique and proven concept of SR Schindler's curling operation, the wear of the brushes is minimized while achieving an optimal outcome. Curling is an indispensable upstream process step for products that need to be coated because it removes the residual dust on the surface using high-pressure cleaning.

The curling machine is equipped with two processing tunnels, each with two brush rollers. The belt is extended for optionally later installation of a further tunnel with two addi-



*Layer pusher and retarder roller conveyor*

Electric cabinets



tional brushes. The brushes, which are arranged at an angle of several degrees, rotate alternately in opposite directions, thus avoiding line marks on the products surface.

On a subsequent accumulating roller chain conveyor, the endless row is opened, and quality control is carried out. Defective products are removed from the product stream by the operator and replaced by defect-free ones. A stopping system integrated into the accumulating roller chain conveyor separates the disintegrating continuous strand into layers, and a layer pusher transfers the individual layers to a belt conveyor. At the end of the conveyor, a second layer stacking device identically executed as the first one picks up layer by layer and deposits them on the waiting transport pallet. The loaded pallets run on a heavy-duty roller conveyor to the position outdoors, where they get picked up by a forklift.

A Siemens S7-1500 fail-safe control system controls the entire finishing line in several control cabinets. The complete line is executed according to the valid European CE norms and provides very high safety. For the plant operation, there are operator panels and one wireless tablet PC with a Wi-Fi connection. This lightweight wireless tablet can control the complete line or troubleshoot when something isn't working as desired. The line can be accessed online via a VPN router, and support can be provided. ■



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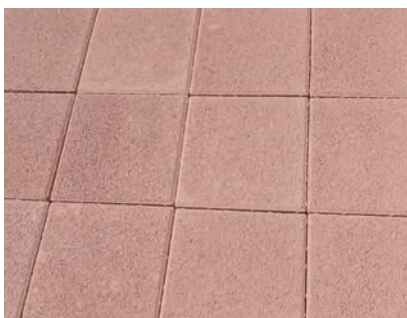
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Product examples

# Oldcastle APG enhances position in high-growth market with new Ridgeway plant

## شركة Oldcastle APG تعزز من مكانتها في السوق عالية النمو من خلال مصنع Ridgeway الجديد

With origins in the Carolinas dating back to 1946 through its purchase of Adams Concrete, Oldcastle APG has become the region's leading supplier of concrete hardscapes, block, and bagging products. A CRH Company, Oldcastle APG's position as North America's leading provider of integrated and sustainable outdoor living solutions is reinforced through ongoing strategic enhancements, such as the addition of its newest site in Ridgeway, South Carolina.

بفضل أصولها في منطقة كارولينا التي يعود تاريخها إلى عام 1946 من خلال شرائها لشركة Adams Concrete، أصبحت شركة Oldcastle APG المورد الرئيسي في المنطقة للألواح الصلبة الخرسانية، والكتل، ومنتجات التكييس. وتم تعزيز مكانة شركة CRH، Oldcastle APG بوصفها شركة رائدة في أمريكا الشمالية في مجال توفير حلول المعيشة المتكاملة والمستدامة في الأماكن الخارجية من خلال التحسينات الاستراتيجية المستمرة، مثل إضافة موقعها الأحدث في منطقة Ridgeway بولاية ساوث كارولينا.

The concept was to build a hardscapes plant outfitted with modern technology that would provide capacity for its customers with face-mix capability, the latest in quality controls, and advanced automation. The desired outcome was to produce top quality and high-capacity throughput for a full range of hardscapes products and solutions to meet growing customer demand.

In its journey to completion, the project encountered challenges. While construction was planned and approved prior to the Covid-19 crisis, site conditions combined with disruptions from the global pandemic created paradigm shifts in services, supply chain processes, and much more.

"The project's successful execution, despite the challenges presented by Covid-19, is a testament to the expertise and



The new Oldcastle Adams Ridgeway plant is located just outside of Columbia, South Carolina and is producing high quality products in high outputs to service the regional market

teamwork of everyone involved,” said Colin Clappett, President of Adams Concrete. “Project Management across Oldcastle APG, equipment manufacturers, engineers, and local officials all came together to get the Ridgeway site across the finish line and the plant is now fully operational.”

### Challenge I: The Site

An available building at the Fairfield County Industrial Park presented an advantage for completing the project in a timely manner without needing to start anew with full building construction. Although the height of the building and interior columns presented engineers with complexities, they were able to carefully adapt their designs to create a highly effective operational result.

Additionally, a seismic zone and limited soils capacity required collaboration between Oldcastle APG engineers and a local engineering team to develop a unique foundation without derailing project feasibility.

### Challenge II: Covid-19 and Supply Chain Breakdowns

The project installation took place at the peak of industry disruptions, supply chain breakdowns and a global health crisis resulting from the Covid-19 pandemic. Fortunately, Oldcastle APG was able to forge ahead despite impediments.

“We suddenly had to adapt our health and safety protocols and processes overnight,” stated Randy Foster, Project Manager at Oldcastle APG. “Keeping everyone safe while constructing a new plant with multiple supplier installation teams working together while meeting Covid-19 safety requirements was something we had never done before.”

The pandemic by-product of supply chain breakdowns added pressure to an already robust workload. Scarcity of resources and key inputs required the team to find creative solutions to meet heightened demand. Through perseverance, dedication and teamwork, the project was completed on time.

“It was not easy, and we had to think outside the box to find inputs that we were told were not available at all or within the required time frame,” said Foster.

### The installation is a mix of suppliers

The core element of the plant is a Masa XL machine which is the same size as the rest of Oldcastle APG’s production supply stable. Added to the design of this site is the large capacity kiln, pallet buffer, automatic quality control for height and product density, unique built-in maintenance accesses, and multi-color blending for both main and face mix systems. Six coarse aggregate bins, combined with one split aggregate bin for face mix, all supplied by Standley Batch, begins the operation. Three cement silos feed the two Haarpur 3750L

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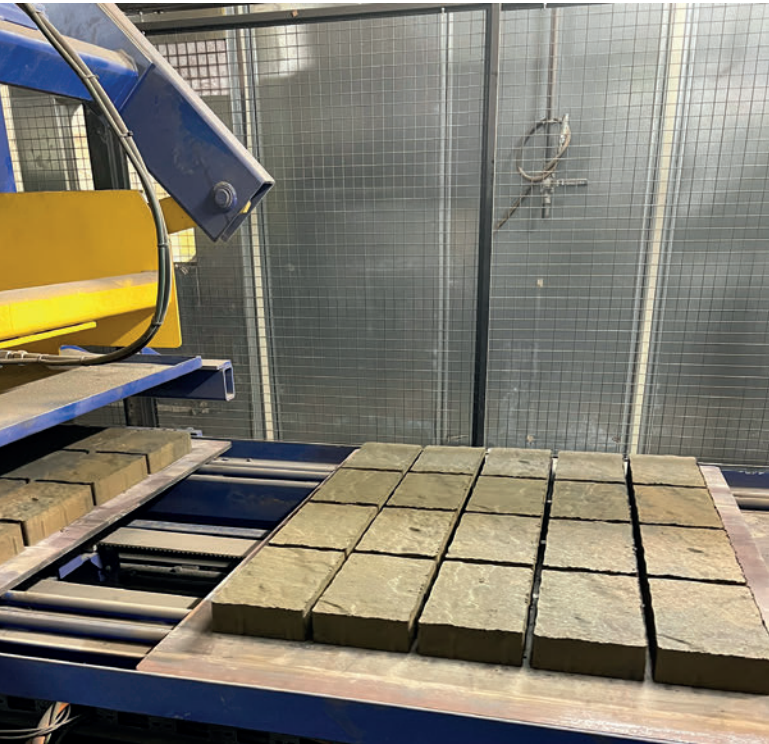
At Masa, we think of nothing but concrete – and how to shape it for the building materials industry. The machines we design and build are used for the production of concrete blocks, pavers or landscaping products, aerated concrete blocks and (reinforced) panels as well as sand-lime bricks. In other words, we are real concrete heads with a passion for reliable, high-performance machines.

Sascha and Nico are two of our concrete heads who ensure the servo-hydraulic driven components installed in the XL-R reach their full potential through their precise craftsmanship. The servo driven pallet feed and V-belt lowering device facilitate a fast, smooth, and highly precise movement of the production pallet in and out of the press, enabling faster cycle times and highly repeatable results.

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Masa GmbH (Production Site Porta Westfalica)  
Autoclaved Aerated Concrete + Sand-lime Bricks  
Osterkamp 2 | 32457 Porta Westfalica | Germany



*A full range of products, from commercial Belgard® pavers, landscaping flats, thin products, SRW walls, edgers and other garden specialties to CMUs, with or without face mix, are made on the Masa XL 9.1 machine.*

main mix and 500L VM face mix mixers. Color hoppers below the mixers provide for measured flow to the multi color blending system. Eagan Controls were used for the aggregate batching, mixing, and feed systems.

### **The Masa XL 9.1 - matched to a broad range of products**

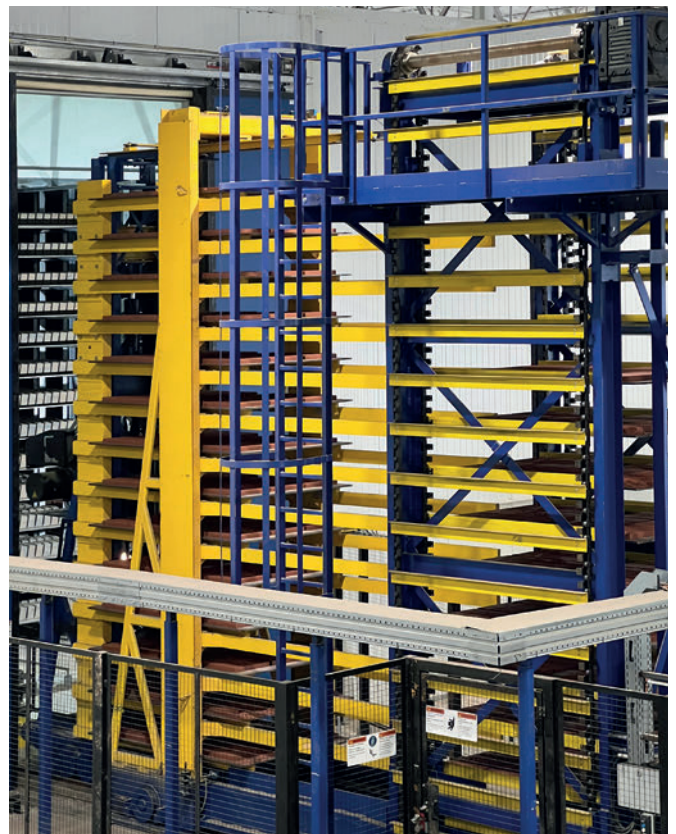
Once mix is delivered to the machine, the Masa XL is perfect for the broad range of products produced at the Ridgeway plant. Equipped with Servo vibration allows rapid changes to the vibration forces from the control desk to optimize the production from simple landscape flats to a full range of hardscapes, including Belgard® commercial pavers, segmental retaining walls and concrete masonry units if needed in the future; all made on this one machine with precision and high efficiency.

### **Curing Plant, Ring Plant and Ancillary Equipment**

The single room curing plant is filled and emptied by a 14-level double lift finger car. This heavy capacity, fully rotating finger car system, features bolted on fingers for ease of maintenance. A V-belt conveyor on the dry side aids in maintaining low dry side cycle speeds to ensure maximum daily output. A centering device, doubling and a low-tension strapper make up the remainder of the dry line components prior to the cubing function.



*Real time animated controls allow the operator to see all processes at any stage from multiple screens.*



*Masa finger car operates within the single room curing chamber.*



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*CDS Active Curing Chamber Environmental control maintains temperature and humidity.*

A CDS active curing system maintains temperature and humidity independently and automatically without stratification through-out the kiln. The CDS system uses mass air flow in conjunction with the humidity and temperature control providing the user to dial in the best set points for the specific product to obtain consistent and repeatable results.

The large plate pallet buffer rack fed by a pallet buffer car between the rack and wet/dry side lines ensures flexibility when speeds between wet and dry sides vary due to different product speeds or short stoppages during production hours. Automated shipping pallet insertion by utilizing a pallet grab system provides rotational options for the pallet placement. A stretch wrapper finishes out the cubing line. Slab Innovations provided an automated tumbling system offline.

**Quality Is Priority**

Delivering superior products for its customers is a top priority at Oldcastle APG, which drove the decision to develop the new plant. Consequently, to assist in the operation, systems for automatic measurement and real-time metrics reporting were included.

An in-line weigh system for product density and a laser system to measure height provide immediate feedback, which were two aspects of this directive that were supplied by Masa. A production pallet dumping device on the wet side allows for other quality checks.

Experienced leadership and pre-launch training has yielded great dividends, according to Gary Ewell, Regional Vice President of Operations at Oldcastle APG.

“From the get-go, this plant has made high-quality product very efficiently and has already proven itself as an asset to



*Masa’s electro driven cuboter precisely places the layers on a conveying system and creates accurate cubes without damaging the products.*

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*„Thumbs up‘ for the new plant in Ridgeway.*

production,” said Ewell. “We look forward to many long years of continued output and service to our customers.” ■



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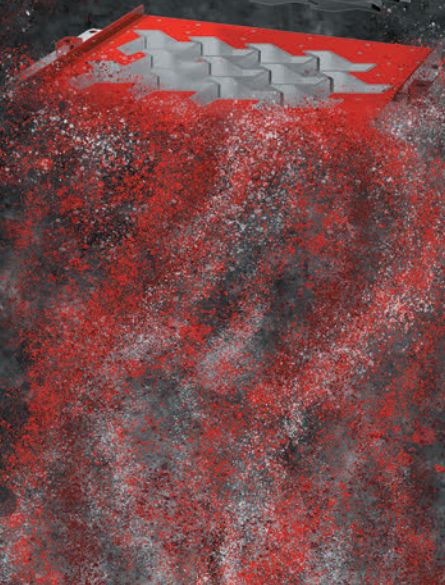


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# The production of building materials from natural expanded clay is worked out to the smallest detail

## إنتاج مواد البناء من الطين الطبيعي المُمدد بنجاح بأدق التفاصيل

Expanded clay blocks are an emerging trend in the construction market. In an era of high natural gas prices and problems with the availability of this raw material, prefabricated expanded clay blocks are an alternative to gas concrete products, among others. Keramzite concrete materials are characterized by high sound insulation and vapor permeability. Keramzite concrete blocks and blocks do not show capillary rise and are characterized by low diffusion resistance. In this respect, expanded concrete blocks distance the competition by showing nearly three times higher vapor-permeability than aerated concrete products.

تمثل كتل الطين المُمدد توجّهًا ناشئًا في سوق البناء. وفي حقبة ارتفاع أسعار الغاز الطبيعي ومشاكل توافر هذه المادة الخام، تمثل كتل الطين المُمدد مسبقًا الصنع بديلًا لمنتجات الخرسانة الغازية وغيرها. وتتميز المواد الخرسانية المصنوعة من زلط الطين "الكيرامزيت" بعزل الصوت العالي ونفاذية البخار. ولا تُظهر الكتل الخرسانية وكتل زلط الطين "الكيرامزيت" ارتفاعًا شعريًا وتتميز بمقاومة منخفضة للانتشار. وفي هذا الصدد، فإن الكتل الخرسانية المُمددة تتأى بنفسها عن المنافسة من خلال تميزها بنفاذية بخار أعلى بثلاث مرات تقريبًا مقارنة بالمنتجات الخرسانية الخلوية.

Expanded clay is a natural material that has been used for many years and is proven in the manufacture of products that must meet stringent standards, such as chimney and ventilation systems.

Keramzite is a lightweight aggregate made from swelling clays. The production process consists in firing at a temperature of about 1150-1200 degrees Celsius of swelling clays after they have been crushed. Rotary kilns are used for this

purpose, in which the expanded clay is given a spherical shape. At the high temperature, the clay expands in volume, and the formed balls become highly porous and durable due to the outer ceramic coating. It is standard to sort the expanded clay according to fractions from 0-4mm to 10-20mm. The volume weight of expanded clay, depending on the fraction, the clay used and the production method, varies between 220 and 380 kg/m<sup>3</sup>.



Czamaninek is a Polish manufacturer of building materials.



Expanded clay in different fractions from 0-4 mm to 10-20 mm.



Of all natural lightweight aggregates, expanded clay has the best repeatability of parameters and their durability over time. That's why it is widely used in the production of lightweight concretes and mortars. It also excels in concrete mixtures intended for use in the manufacture of vibro-pressed elements.

These properties have been appreciated by Czamaninek-Producer of Building Materials, which has found its niche and for many years has been producing various expanded clay products using a complete technological line designed and manufactured by Techmatik S.A.

Czamaninek is a Polish manufacturer of building materials. The company has been active in the construction market since 1991 and today is the leading manufacturer of prefabricated expanded clay products in Poland.

*"The production process at Czamaninek has been refined down to the smallest detail, from the entry of raw materials into the plant to the transport of building materials to our customers' construction sites."*

**Anna Makowska - Director of Development, Czamaninek Producent Materiałów Budowlanych SP. z o.o.**

Thanks to investments in research and a modern production line, Czamaninek can guarantee the high strength and load-bearing capacity of the building materials it offers, while retaining all the advantages of expanded clay.

Modern technology of production of expanded clay concrete elements allows to obtain sound insulation  $R_w$  even at the level of 58dB with only 18 cm of thickness of the partition.

*The heart of the production line is the Techmatik SHP 5000 PRO C multifunctional vibratory press.*



*The Techmatik SHP 5000 PRO C is designed for fully automated processes with a capacity of 250 cycles per hour.*



The machine allows the production of a wide range of products, with heights ranging from 40mm to 550mm.

*"We chose the Techmatik process line because of the advice, the completeness of the offer, the exceptional power of the vibropress and the possibility of locating the complete process line in a relatively small area. The fast turnaround time and availability of service were also a great advantage."*

**Waldemar Sadowski - CEO, Czamaninek Producent Materiałów Budowlanych SP. z o.o.**

### Techmatik production line

The Techmatik Technological Line allows the the production of 34,000 products per day with 2-shift production. The line is operated by a total of 3 people.

The heart of the production line is the Techmatik SHP 5000 PRO C multifunctional vibratory press - a machine designed for fully automated processes with a capacity of 250 cycles per hour. The machine allows the production of a wide range of products, with heights ranging from 40mm to 550mm.

The construction of the Techmatik SHP 5000 PRO C machine uses technical solutions used in the construction of precision industrial robots. Efficiency and low operating costs have been taken care of here.

The Techmatik automatic line in operation at Czamaninek also includes, among others; aggregate transport systems, planetary mixers - used to prepare a precise mixture of expanded clay concrete, Robomatik packaging robot, wrapping machine with simultaneous wrapping of products with stretch film and tape with the manufacturer's logo, finished product transport systems, countertop feeder, shortage tippler, stacking and spreading equipment, countertop sprinklers and seasoning machines.

Techmatik steel molds for hollow blocks and other components are also used in production. Thanks to its modular design, the complete Techmatik line (excluding the concrete batching plant) is housed on an area of just 600 sqm.

Among Czamaninek's products we can find foundation blocks, expanded clay blocks for structural and partition walls, as well as ceiling elements, fittings and lintels. As a result, Czamaninek provides its customers with a complete system for the construction of all parts of a building.

In 2021, due to intensive commercial activity and high demand for prefabricated expanded clay products, Czamaninek decided to expand the production hall and purchase a second Techmatik line in the same configuration. The new line includes a modern and fully automated racking system with an area of over 850 m<sup>2</sup>. Also new will be a height calibration (hollow block grinding) line. The line is scheduled to be operational by the end of 2023.



Finger car in the curing chamber



*Keramzite concrete materials are characterized by high sound insulation and vapor permeability.*

*Expanded clay blocks are an emerging trend in the construction market.*



*"We are pleased that thanks to our activities, more and more customers in Poland are building their houses using prefabricated expanded clay technology. Already today, customers who have built houses with our blocks boast about their savings on heating and electricity. The new line will make this technology even more accessible to investors. The addition of the calibration line will provide construction teams with a product with the highest possible accuracy. Perfectly even blocks will make masonry work easier and faster, ultimately reducing investment time and costs."*

**Waldemar Sadowski - CEO, Czamaninek Producent Materiałów Budowlanych SP. z o.o.**

**FURTHER INFORMATION**

**CZAMANINEK**  
MOC W JAKOŚCI

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Afinitas Headquarters, St. Louis, MO 63105, USA

## New pipe making equipment system positions Hong-Ik for future in South Korea

### نظام معدات تصنيع أنابيب جديد يضع شركة Hong-Ik على عتبات المستقبل في كوريا الجنوبية

The concrete market is evolving rapidly in South Korea, and Hong-Ik Co. Ltd., a concrete product producer based in Seoul, wanted to be at the forefront with the latest technology. In researching options to replace their aging pipe making equipment, they found the BFS Souveraen by Afinitas to be a perfect match. The Souveraen offered them more automation and efficiency, plus added capabilities to take on opportunities in emerging markets.

يشهد سوق الخرسانة تطورًا سريعًا في كوريا الجنوبية، وأرادت شركة Hong-Ik Co. Ltd.، وهي شركة منتجة للمنتجات الخرسانية يقع مقرها في سيول، أن تكون في طليعة التقنيات الحديثة. وخلال رحلة بحثها عن خيارات تحل محل معدات تصنيع الأنابيب القديمة، وجدت أن سلسلة آلات BFS Souveraen من Afinitas الخيار الأمثل المطابق تمامًا. فقد وفرت لهم سلسلة آلات Souveraen المزيد من إمكانيات التشغيل الآلي والكفاءة، بالإضافة إلى إمكانيات أخرى تمكنهم من اغتنام الفرص في الأسواق الناشئة.

As the management team of the Hong-Ik Co. Ltd. concrete plant near Seoul, South Korea carefully studied its options for replacing their aging pipe production equipment, there were several possibilities. But in the end, one of the clear difference-makers was a corrosion-resistant polymer concrete

pipe lining feature from Afinitas. The Korean team couldn't resist Ecoresist.

While the BFS Ecoresist Concrete Pipe Liner System from Afinitas may have helped seal the deal, it wasn't even part of the final package. That comes later.



Hong-Ik-1 - The Afinitas BFS Souveraen system installed at Hong-Ik Co. Ltd. in Seoul, South Korea



Left to right: Mr. Kim, Hong-Ik General Manager; Rainer Straub, Afinitas Sales Manager; Mr. Lee, Regional Sales Agent

# HawkeyePedershaab and BFS Box Culvert Production

**One Modular Mold Set. All Box Culvert Sizes.**



## **System Benefits:**

The molds can be used in different plant configurations - either in a machine or egg-lay solution with many advantages over traditional wetcast production:

- **Make all box sizes with higher productivity and less labor.**
- **Pegged and machined mold components facilitate precise assembly.**
- **Strong design withstands vibration and stripping forces and dead-weight stresses without flexing or sagging.**

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Newly produced pipe from the BFS Souveraen



Inside the large production space in the Hong-Ik factory

Rainer Straub, Equipment and Automation Division Sales Manager for Afinitas, guided the project through COVID-related delays and other unforeseen hiccups along the way.

In a process that spanned visits to several countries 5,000 miles (8,700 km) apart, months of planning and the COVID pandemic, the BFS Souveraen system went into service in spring 2021.

### Retiring a Workhorse

Hong-Ik needed to replace its workhorse HawkeyePedershaab pipe system that had been in service for decades, according to Straub. With advances in equipment technology and opportunities in the market, it was time to increase automation, ramp up speed and improve quality.

Straub and Afinitas agent Lee Moon-Hi escorted the Hong-Ik delegation on a tour to experience the new technology, first traveling to Germany to view the Ecoresist pipe liner, then heading to Luxembourg to see a Souveraen plant in action. "This is a trip we've done in the past with other companies," Straub said. On this visit, it was the Ecoresist that caught the fancy of the Hong-Ik group.

"We explained the advantages of the Souveraen machine," Straub said. "There were three. "One is our drive system. It's modern electronics versus the old-fashioned hydraulic drive system. The second is the speed of the machine. Our machine has much higher output rates. And the third was the compaction tool. We have four layers of rollers for complete compaction compared to others that have only two layers." Souveraen's patented roller-head technology consists of multi-level rollers. The amount of concrete is fed to through the roller-head layers in precise quantities, ensuring uniform compaction throughout the entire pipe length. The coun-

ter-rotating movement of the rollers ensures that the reinforcement cage is perfectly embedded by the concrete and twisting of the cage is minimized. It is the gold standard for dry-cast pipe compaction.

The Hong-Ik team was impressed with the Souveraen's advanced roller-head system, but the final difference was the Ecoresist technology, which embeds a polymer inner lining into the pipe during production. The lining withstands the effects of aggressive biogenetic gases generated in wastewater that flows through underground piping systems and can corrode untreated concrete pipe.

"In the end, the main reason Hong-Ik decided to go with us was the possibility of producing Ecoresist pipes," Straub said. "We supplied some samples of the pipe, because they want to introduce this new product into the Korean market. This is only possible with our Souveraen machine."

### Commissioning During COVID

Planning for the decommissioning of the old Pedershaab plant and the onboarding of the new Souveraen was well underway when the COVID pandemic hit. It took extra time and effort to enable Afinitas installation technicians to travel from Germany to South Korea, with limited visas and 14-day quarantine periods slowing everything down.

Lee Moon-Hi, the Afinitas sales agent, and Takkyun Woo, quality control director for the Hong-Ik facility, bridged the language barrier to help keep communication going. Woo is the only English speaker among the 22 employees at the plant and worked closely with Straub throughout the project. Hong-Ik has been in business since 1946 and produces interlocking blocks, bench flume and concrete boxes in addition to pipe. But pipe is by far the most important product.



The Hong-Ik Co. Ltd. facility in Seoul, South Korea

“Government-funded infrastructure projects are our biggest market, roughly 80 percent,” Woo said. “We produce about 40,000 tons of concrete pipe in a year, but we plan to increase production in the future.”

With Souveraen on board, that should be no problem. Hong-Ik is now more efficient than ever. “Production has doubled, quality has improved a lot and we have cut labor in half,” Woo said. “We can control the machine easily, and this system makes it very helpful.”

With Souveraen, Hong-Ik now produces its daily pipe run with just one person. At the start of the day’s production, Woo said he monitors the mix design for about 30 minutes. The Souveraen robotics system handles the rest. From there, the only personnel needed is the forklift driver, who sets cages and moves the pipes from the turntable to the kiln. The forklift driver also monitors moisture content during the process and can adjust the amount of water if needed.

For Woo, one of the biggest differentiators of the Souveraen machine is its four-level roller-head design and the Afinitas control system that enables Souveraen to pack the concrete with higher pressure and less torque. This combination produces even compaction through the entire pipe length in one pass, which speeds production. Some other systems require two passes to fully pack the form.

### Forefront of Pipe Production

The new Souveraen technology puts Hong-Ik at the forefront of pipe production in South Korea. The addition of the Ecoresist system, when added, will enable Hong-Ik to produce the country’s first lined pipe and further separate the company from other producers.

Although the concrete pipe industry is rapidly evolving in South Korea, Straub said that some concrete producers in



BFS Souveraen production software allows producers to easily monitor the manufacturing process

Korea are still manufacturing pipe using the wet-spin method first developed in Australia more than 100 years ago.

“This is old fashioned technology,” Straub said. “The quality is not as good and the machines are very old, so some Korean manufacturers are now considering whether to stop production or invest in new drycast pipe systems.”

For now, Hong-Ik is moving boldly into the future and taking advantage of labor savings, higher output and top quality from its Souveraen system. When Ecoresist comes aboard, Hong-Ik will be manufacturing concrete pipe for Korean infrastructure that is hard to resist. ■

### FURTHER INFORMATION



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# New Trends in PPVC technology

## اتجاهات جديدة في تقنية الإنشاءات الحجمية الجاهزة مُسبقة الصنع (PPVC)

**Prefabricated Prefinished Volumetric Construction (PPVC) is a construction method whereby free-standing 3-dimensional modules are completed with internal finishes, fixtures and fittings in an off-site fabrication facility, before it is delivered and installed on-site.**

الإنشاءات الحجمية الجاهزة مسبقة الصنع (PPVC) عبارة عن طريقة إنشاء تُستكمل من خلالها الوحدات ثلاثية الأبعاد القائمة بذاتها بتشطيبات وتجهيزات وتركيبات داخلية في منشأة تصنيع خارج الموقع، وذلك قبل تسليمها وتركيبها في الموقع.

The use of PPVC allows: Improved Productivity, up to 40% in terms of manpower and time savings, depending on the complexity of the projects; A "Better Construction Environment"-as the bulk of the installation activities and manpower are off-site, it minimises dust and noise pollution and improves site safety; Improved Quality Control-Off-site fabrication in a controlled factory environment can produce higher quality end products.

When using PPVC the following factors need to be considered:

- Early contractor involvement- Developers/project managers should obtain inputs from the PPVC supplier or manufacturer as well as the Main Contractor at the design stage. This helps in developing effective technical solutions for the project. For example, the choice of the right method will dictate the size and number of modules in the design as weight is a major consideration for the lifting of the modules.
- Site/project management - The condition of the roads surrounding the project must be able to accommodate the weight and size of the PPVC module delivery. Access to and within the site must be able to accommodate loaded trailers. It may not be practical to store many large PPVC modules on-site, and a Just in Time (JIT) installation would prevent unnecessary double handling. The crane deployed on-site must be able to handle the weight of the PPVC modules and its location should be properly planned so that it can reach all blocks for the installation of modules.
- Maintenance, replacement, and renovation- It is good practice for developers/builders to provide a homeowner user manual of the PPVC upon completion of the project. For any renovation works, it is recommended for homeowners to engage a renovation contractor, who would use the appropriate tools and follow the instructions provided in the homeowner user manual. There are various types of PPVC construction and one way of dif-



*Multi-storey residential building, made of modules in PPVC technology*

differentiating these is to look at the production methods which provide the 3-D block erected on site.

The production methods can be classified as follows:

- “Component Systems”, where a series of flat panels are manufactured, then welded together to create the desired final module shape.
  - Advantages:
    - Fast installation
    - Can be 85 to 90 % completed off site
    - Extremely fast production. Flat panels can be manufactured quickly and efficiently.
    - Extreme design flexibility
    - Excellent insulation characteristics
    - Reduced material consumption
    - Easy to finish in factory
  - Challenges:
    - More labor intensive than other PPVC systems
    - More challenging dimensional control
    - Multistage QA/QC
    - Requires more connections (cost implication)
    - More joints- potential sound transmission issues
    - Stability for transport and erection
- “Concrete Frame Systems”, where a basic concrete frame in a ‘U’ or an ‘L’ shape is cast, then further flat panels are added to the frame to complete each module.
  - Advantages:
    - Stable units resistant to torsional loads during transport
    - Fast installation
    - Stable once in the building, no need for shoring or propping.
    - Can be 85 to 90% completed off site.
    - Extremely fast production. Well planned factories can use forms 3 x per 24 hour cycle.
    - Very low labor content in the finished building
    - Excellent QC/QA
    - Extreme design flexibility.
    - Excellent insulation and sound transmission characteristics
    - Reduced material consumption.
    - Excellent dimensional control
    - Easy to finish in a factory
  - Challenges:
    - Electrical distribution
    - Protection of finishes during transportation
    - For high efficiency needs JIT production to site



“ Since 1964 an international leader in design and implementation of customised solutions for precast concrete factories “



*Prefabricated pre-finished volumetric construction for a villa project*

- “Vault Systems”, used for over 50 years to produce hotels, prisons and other repetitive structures up to 20 floors high which can be finished internally and externally, with or without plumbing and equipped with bathroom and kitchen fittings, easily dispatchable, even over long distances. These structures also have excellent seismic performance and a high quality of acoustic and thermal insulation, greatly reducing the presence of thermal bridges. These units are generally made from very large (L = 6 m-> 9 m, W = 3 m + 6 m, H = 2.6m-> 3.5 m) 5- or 6-sided formwork and generally weigh upwards of 20 metric tons.
- Advantages:
  - Very stable units resistant to torsion loads during transport
  - Easy to install, providing the production and detailing are well thought out
- The building needs no shoring or propping
- Can be 90 to 95 % completed off site and easily closed off for protection during transport
- Fast production and installation
- Easy sound insulation between floors/ apartments
- Low labor content in the finished building
- Good dimensional control
- Excellent QC/QA
- Challenges:
  - Weight
  - Higher level of concrete consumption (double walls and floors)
  - Design flexibility
  - Difficult external insulation
  - Difficulty in using the same mould/form 2 times per day
  - Final building appearance (less architectural flexibility)



*Production of free-standing 3-dimensional modules with PPVC technology*

In the last few years, the demand for housing worldwide has grown exponentially, from single luxury villas to multistorey apartment blocks and catering for social housing needs.

The success of a housing project very often depends on the choice of the correct engineering (both structural, architectural and MEP [mechanical, electrical, and plumbing]) and of the best production technology.

The latest trends in PPVC architecture is: maximization of modules span with the optimization of concrete ratio (element thickness), keeping into consideration the need for flexibility in the dimensions of each PPVC unit.

The production technology must integrate the inputs above with the need to maximize the finishing activities within a factory environment in order to reduce construction time.

The best strategy is to create an industrial process in a sector where onsite activities have often been predominant, thus causing long waiting times as well as contingencies and extra costs.

Reduction of manufacturing time as well as more control possibilities can give only advantages to both contractors, producers and more importantly the final users. PPVC modules are likely to be "plug and play" type, as they should exit the manufacturing process with all the finishes, interior walls, and MEP inside, so that only mechanical dry connections are needed onsite.

The engineering of the building system must be completely integrated in all its parts: architecture design, structure design, MEP layout, reinforcement distribution, concrete mix design are all part of a BIM (Building Information modeling) that grows during all the design phases and keeps track of all the modifications, as it grows. The BIM model with all its attributes must be integrated with the manufacturing ERP (Enterprise resource planning) in order to always have a clear idea of "costs & benefits."

Manufacturing facility must be equipped with "state of the art" technological processes like: 3 dimensional moulds with adjustable parameters that can be modified to suit a range, such as length, width and height of the modules, as well as wall thickness, with a reduced changeover times; circulation lines where raw prefabricated blocks pass through several work "stations" which allow different activities to be achieved, such as external finishes ( applications of insulation, cladding), interior finishes i.e MEP installation, doors and windows fitting, tiling, kitchen and bathroom installation and painting.

On-site activities should be limited to dimensional control, modules handling with cranes and fixing. ■

### FURTHER INFORMATION



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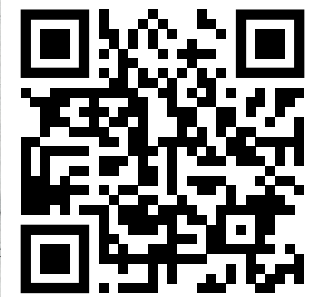
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# Flexible formwork systems according to the modular principle

## أنظمة صب الخرسانة المرنة وفقاً للمبدأ المعياري

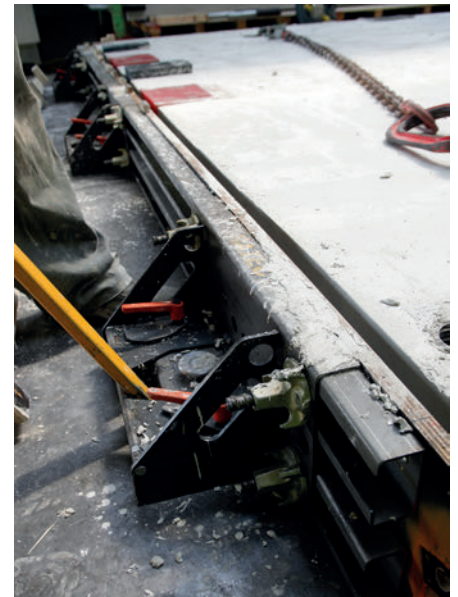
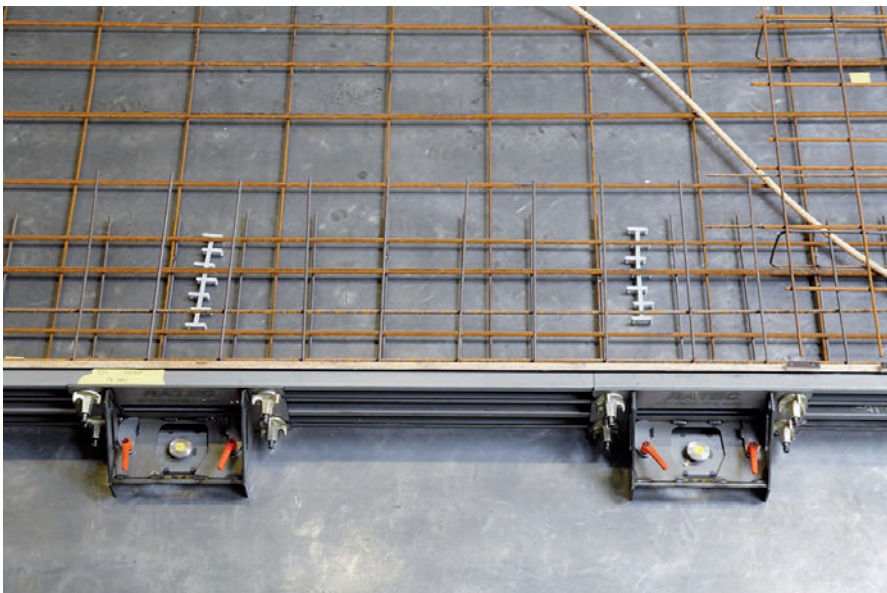
The build-up or expansion of a flexible formwork inventory does not necessarily have to be accompanied by high investment costs. High-quality, durable and reliable formwork solutions can also be put together cost-effectively - thanks to the modular principle. The article provides an overview of the three systems that formwork specialist Ratec offers its customers as flexible modular solutions for numerous formwork tasks, and which can also be implemented without a high initial investment.

لا يتعين بالضرورة أن يصاحب بناء مخزون قوالب صب الخرسانة المرنة أو توسيعه تكاليف استثمارية عالية. ويمكن أيضاً وضع حلول قوالب صب خرسانة عالية الجودة، ومتينة وموثوقة معاً بتكلفة فعالة - وذلك بفضل المبدأ المعياري. تقدم المقالة نظرة عامة عن الأنظمة الثلاثة التي تقدمها شركة Ratec المتخصصة في حلول القوالب لعمالها كحلول معيارية مرنة للعديد من مهام صب الخرسانة، والتي يمكن تنفيذها أيضاً دون استثمار أولي كبير.

The basis for all these formwork systems is the switchable magnet box SPB. The Standard Pro Magnetbox has become a classic and is used in many factories around the world. The magnet box is equipped with holders to attach adapters or formwork skins of any kind. The hole spacing originally defined by Ratec for accommodating the screw fittings is now standard in numerous competitor products. Due to the strong and reliable holding force of the magnet boxes - from 450 to 2,100 kg - many applications are possible with just a few components.

### Practical tip

In practice, it is striking that often far more magnet boxes are used than necessary for a given formwork length and height, in keeping with the motto "a lot goes a long way". With original Ratec magnet boxes, however, you usually need far fewer magnets for the target length and height of an element. As a rule of thumb and recommendation, the manufacturer prepared an overview for the necessary number of magnets depending on formwork length, height and holding force of



The classic of the adapter systems: PSV Pro System Vario, here PSV<sup>2</sup>

## PRECAST CONCRETE ELEMENTS

the magnet box, which are available in the catalogue and on request.

### The classic - PSV Pro System Vario

For more than 20 years, PSV has been successfully in use with its variability and user-friendliness. PSV stands for profitable, systematic and variable, or Pro System Vario for short, as it allows formwork height variability from 100 to 500 mm as well as telescopic length graduation in the millimetre range. The formwork system is used on stationary tracks, tilting tables and circulation plants and can be relocated and assembled by hand or using the handling crane. Both wood (Betoplan, alkus, etc.) and steel for high series are used for the formwork skin. The formwork can be prepared independently of the tilting table or the circulating pallet. This helps to keep formwork skin material waste as low as possible.

### Practical tip

With the standard C-rail length of 250, 1100, 2000 and 3000 mm, any formwork length from 550 mm to 3500 mm can be implemented without gaps. This means that maximum flexibility can easily be achieved with the standard components. The manufacturer offers an overview of possible combinations for the flexible length grid in its catalogue and on request.



*MST can also be used flexibly for recesses*

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*Special feature: MST can be coupled for double-sided use*

PSV is:

- Flexible in height by changing adapters for heights from 100-500 mm
- Flexible in length due to standard length grid of the C-rails for formwork lengths from 550 - 3500 mm
- Extendable with an extension arm and a special corner bracket for use with recesses
- Easy to handle due to quick fixing and detaching of the formwork skin using Dywidag bolting of the C-rails
- Advanced version PSV<sup>2</sup> for shuttering and demoulding without re-measuring

### The lightweight for manual handling and concreting on both sides - MST

The modular formwork beam MST stems from the desire to offer a system that is simple, versatile and, above all, lightweight, while being able to cover many different formwork tasks. The MST is universally applicable for the production of wall and ceiling elements from 100 to 500 mm thickness. The system combines the advantages of various other solutions as it is flexible in both length and height, consists of few individual parts and impresses with its low weight and easy handling. The formwork beam is attached to the magnet box SPB 2100 by clamping brackets and serves as a base for attaching the formwork timber or front sheet.

The very good static properties, which were tested in the precast plant, and the special variability of the MST make this formwork system a real all-rounder. With its low weight, the modular formwork beam is optimised for manual handling and remains below the BG standard with a weight of less than 21 kg per 3 m length. Two special features characterise the MST: it is stackable, so that precast concrete manufacturers can realise almost all required element thicknesses with just one height of the base beam. And the MST can also be coupled for use on both sides, which saves space on the pallet and reduces effort. With smart accessories such as an exten-



*MST extension for the production of upstands*

sion arm or window corners, the MST can also be used for recesses or for upstands.

### Practical tip

For individual lengths, the MST base profile with standard length of 2,980 mm can be cut to lengths of 532, 940, 1,348, 2,164 and 2,573 mm. Ratec can provide a corresponding pattern if required.

In summary, the MST is:

- Stackable for wall thicknesses from 100-500 mm
- Flexible in length as the base beam can be cut to desired lengths or "extended" with connecting plates for the longitudinal butt joint of two MST base beams
- Expandable with an extension arm for the production of upstands
- Couplable for double-sided use
- Easy to handle due to fast (re)setup time and low weight

### The Flexible - Easy Form

The smart Easy Form system was specially developed for use with difficult formwork geometries and complex connecting reinforcement. A special feature in contrast to PSV and MST:

# HYDROCLICK

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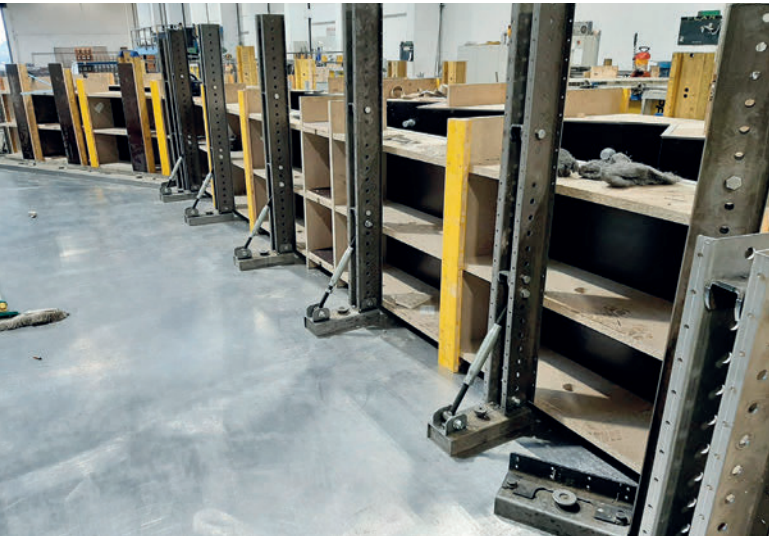
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Decades of experience and R&D





With the Easy Form vertical supports, elements such as columns or stairs up to 1 m in height/thickness can be produced

Easy Form can already be used for shuttering heights from 45 mm. The system can be used as a longitudinal or transverse shuttering for all flat precast concrete parts with wall thicknesses of 45 - 400 mm and for recesses. Easy Form is designed according to the modular system and consists of standard components that can be easily combined. If you like model kits, you will love Easy Form. The modular principle enables fast and efficient assembly and ensures maximum combinations with just a few accessories. Also, Easy Form is suitable for continuous reinforcement and offers standardized components for this purpose, such as closure parts for reinforcing bars with diameters of 16 - 32 mm. With the flat base, continuous reinforcement from 25 mm height can be realised.

Easy Form is:

- Height flexible through exchange of the ribs
- Flexible in length due to different standard lengths of base profile and connecting plates for connecting two base profiles
- Can be extended with accessories for mounting vertical supports, which can also be used to form special elements up to 1 metre high
- For handling, crane and robot fixtures can be flexibly attached

In summary, Ratec's flexible formwork solutions are a very cost-effective way to build up a versatile set of formwork components that can be extended over time and therefore do not require a very high initial investment. The magnet technology of the SPB Standard Pro magnet box with a reliable holding force of up to 2,100 kg is the basis for a wide range of applications. The formwork specialist's team is happy to pass on practical advice for efficient use as well as maintenance and care instructions to its customers. ■

FURTHER INFORMATION

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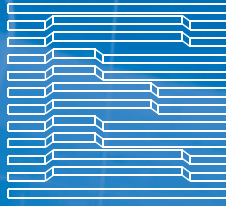
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Easy Form with continuous reinforcement

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e-mail: info@eurobend.com



Eurobend GmbH, D-90547 Nuremberg-Stein, Germany

# Fully Automatic Lattice Girder Welding Machines

## آلات لحام العارضة الشبكية الأوتوماتيكية بالكامل

The range of Eurobend GmbH includes sustainable solutions and an extensive range of automatic mesh welding and reinforcing steel processing machines for all types of precast concrete applications. Special solutions for the production of meshes, wire spacers, lattice girders and reinforcement systems for the precast industry are offered and are used successfully in leading precast plants worldwide.

تضم مجموعة Eurobend GmbH حلولاً مستدامة ومجموعة واسعة من آلات اللحام الشبكية الأوتوماتيكية وآلات معالجة فولاذ التسليح لجميع أنواع استخدامات الخرسانة الجاهزة. وتُقدّم حلول خاصة لإنتاج الشبكات، والفواصل السلوكية، والعوارض الشبكية، وأنظمة التعزيز لصناعة الصب المُسبق وتُستخدَم بنجاح في مصانع الخرسانة الجاهزة الرائدة في جميع أنحاء العالم.

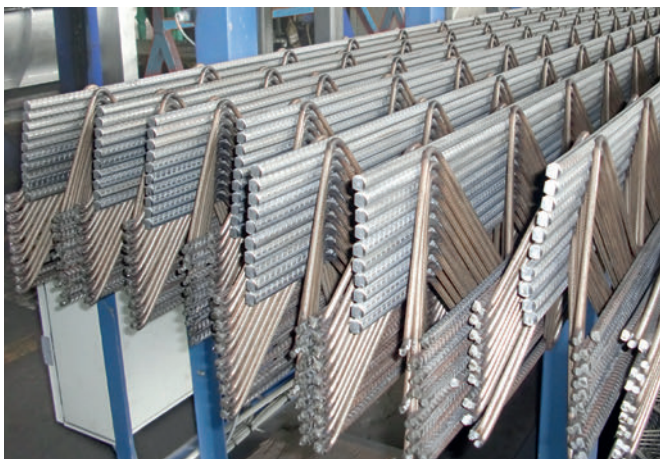
The "PL-TRIS" Series of Lattice Girder welding lines can produce most types and sizes of Lattice Girders and offer reliable and cost-effective production. Different models are available for both the economic and high output production of Lattice Girders.

Powered de-coiling stations with wire tension sensors for the line and diagonal wires or wire loop buffer systems equipped with anti-twist modules, depending on the machine type, ensure that the wires are fed evenly and precisely.

Depending on the model, the wire straightening system uses roller or rotor straightening technology with hyperbolic rollers. This ensures the production of high-quality lattice girders. Unique continuous bending system, for double and quad step lines, with retractable bending pins for the two diagonal wires, ensures accurate and consistent operation.



PL TRIS machine with loop accumulator and collector for lattice girders up to 15m



Typical lattice girder production



PL TRIS - Fully automatic stacking unit

PL TRIS Model		8-250	10-300	10-300 TWIN	10-300 TETRA	12-300	12-300 TWIN	14-300
Lattice girder height	mm	50-250	70-300	70-300	70-300	70-300	70-300	70-300
Upper line wire	Ø mm	4-8	5-10	5-10	5-10	5-12	5-12	6-14
Lower line wires	Ø mm	4-8	5-10	5-10	5-10	5-12	5-12	6-14
Diagonal wires	Ø mm	3-6	4-7	4-7	4-7	4-7	4-7	5-8
Diagonal wires - step	mm	200	200	200	200	200	200	200
Lattice girder base width	mm	60-100	70-110	70-110	70-110	70-110	70-110	70-110
Operating speed	m/min.	12	15	30	50	15	30	15

Flexible welding heads with electrically driven height adjustment for the production of various lattice girder sizes. Hydraulic clamping units, mounted on a servo-motor driven carrier, ensure accurate feeding of wires and Lattice Girders. High-speed cutting operation ensures continuous lattice girder production.

Fully automatic, synchronized stacking and batch removal modules are available. User friendly software requires no programming skills. One operator is only required to supervise the production process and remove the automatically produced Lattice Girders.

Software includes fault detection and supervision of all machine operations for efficient and accurate production.

Remote access via an Internet connection for troubleshooting and routine maintenance. ■

FURTHER INFORMATION



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# MADE IN JAPAN

## Precast moulds & equipment

- 53 years of experience
- Exporting to 20 countries
- One-touch collapsible inner core
- All custom-made
- Watertight



**TOYOTA FORMS**  
 Molds for Precast Concrete



# A family success story: "Invisible arms of my father"

## قصة نجاح أسرية: "ذراعا والدي الخفيتين"

When Eri Toyoda was a little girl, it was rare for her to see her father in the house. He was already at work when she woke up in the morning and was still at work when she went to bed. When her father was meant to be home on Sundays or Holidays, he was called away. Nights were often spent out to dinner with customers rather than at home with the family. It was many years later when Eri genuinely understood what he was doing with his company.

عندما كانت إيري تويودا طفلة صغيرة، كانت نادرًا ما ترى والدها في المنزل. فعندما كانت تستيقظ في الصباح يكون قد ذهب إلى العمل بالفعل وكانت تخلد إلى فراشها قبل أن يعود منه. وعندما كان يحين وقت إجازته ومكوته في المنزل أيام الأحد أو الإجازات، كان تظهر لهم أمور تستدعي خروجه. وغالبًا ما كان يقضي الليالي لتناول العشاء مع العملاء بدلاً من أن يقضيها في المنزل مع أسرته. وكانت قد مرت سنوات عديدة عندما فهمت إيري حقًا ما كان يفعله بشركته.

Toyota Forms is a Japanese company that manufactures custom molds and equipment for manufacturing precast concrete products. The company was founded by her father's father, Yuzuru Toyoda in 1966. Her father, Minoru Toyoda succeeded the company in 1992. He enjoyed his work. He was intrigued by the innovative mechanics of the molds that his father and the company's best engineers invented. It was moving for him to see the manufacturing skills and craftsmanship of the processing and assembly engineers at each of the factories were developed and refined over decades.

Today, Toyota Forms' precise and watertight molds are exported to over 20 countries around the world, and their expansion into the world was largely attributable to Minoru Toyoda. He decided to study abroad in the US for 8 weeks to learn English. After being hugely frustrated after not being able to understand the word "pool" when asked by an American on the street while studying at university, he was driven to learn. He then went on to speak English before he joined Toyota Forms. Toyota Forms has delivered a number of molds to the US since 1991. With his overseas expansion team, he



Toyota Forms is a Japanese company that manufactures custom molds and equipment for manufacturing precast concrete products.

### Invisible arms of my father

"I don't have a father"... as a child, this is the line I had planned to use on my wedding day in the future. Well, I do have a father. I just wanted to start my wedding speech with this line when I was 12 years old.

On Reflection, this makes me sound very ungrateful; but as a little girl, I had a reason for starting my big day with this line.

These days, however, the shocking opening line of my wedding speech has completely disappeared from my mind and my father has become my favorite person.

Eri Toyoda



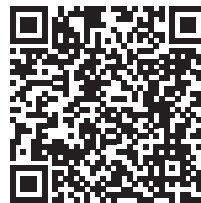
High-quality, high-performance and robustness are the key properties of the molds.

then decided to exhibit at bauma show in Germany as the only exhibitor from Japan in the field of molds for precast concrete products. A competitive nature sometimes seems to serve the company well for its development.

“Small and medium sized business owners put their lives on the line to protect their companies”, he said to his daughter in her first year at Toyota Forms when they were talking alone. Of course, she thinks from observing her father that running a company as the owner can be difficult and challenging at times, particularly when something isn’t going well. But Eri still sees the invisible arms of her father that surround all of them in the business today.

Eri Toyoda is now in charge of overseas marketing and sales for Toyota Forms. Today they also manufacture and export molds from their 100% subsidiary company in India “Toyota Forms India’, to a number of countries. Their non-hydraulic

molds are very precise, easy to use; lasting for more than 20-30 years with little maintenance. High-quality, high-performance and robustness are the key properties of these molds, always produced with made in Japan spirit! ■

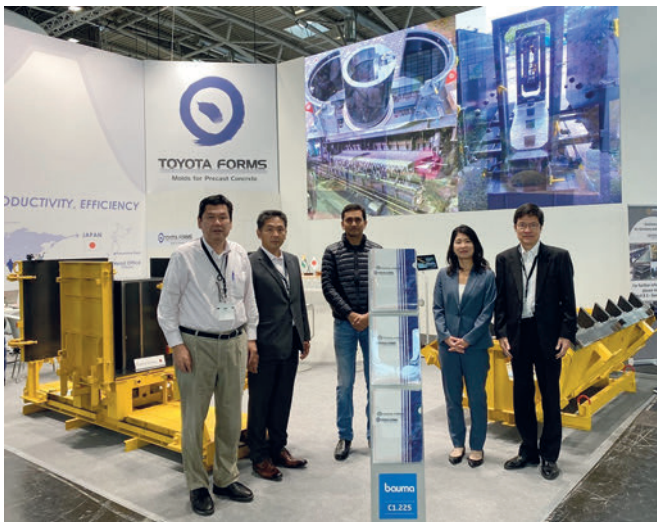


Company introduction video

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Toyota Forms at bauma 2022 in Munich, Germany



In the middle, Minoru Toyoda (left) and his daughter Eri Toyoda, together with Turkish customers at bauma 2022.

Moldtech S.L., 41500 Alcalá de Guadaira (Sevilla), Spain

# New precast plant for industrial, infrastructure and civil engineering in Transylvania, Romania

## مصنع خرسانة جاهزة جديد للهندسة الصناعية، والمدنية، وهندسة البنية التحتية في ترانسيلفانيا، رومانيا

Moldtech has successfully completed the installation of a big new entire plant, being part of one of the most important projects in Transylvania region. For the development of industrial building, infrastructure and civil works projects, a company based in Romania relies on the proven experience of Moldtech, both in the sector and in the Romanian market, hiring the design and manufacture of the following equipment.

لقد أكملت شركة Moldtech بنجاح تركيب مصنع ضخم جديد كليًا، كجزء من أحد أهم المشروعات في منطقة ترانسيلفانيا. ولتطوير المباني الصناعية والبنية التحتية ومشروعات الأعمال المدنية، تعتمد شركة يقع مقرها الرئيسي في رومانيا على الخبرة المثبتة والمؤكدة لشركة Moldtech، سواء في القطاع أو في السوق الرومانية، حيث تستقدم تصميم المعدات التالية وتصنيعها.

The universal casting beds with dimensions of 125 meters length and 1,2 meters width, are equipped with a prestressing system set with a total prestressing capacity of 1.500 tons. The universal casting beds are made up of a support structure which is used as the base where the lateral moulds will be placed to cast the different prestressed concrete elements. By means of prestressing systems, made up of slackening heads and hydraulic tensioning equipment, the steel cables are tensioned to produce high-resistance precast concrete elements. In addition, the baseplates include sealing gaskets to ensure a perfect sealing of the mould.

The universal casting bed could incorporate a heating system, with the purpose of accelerating the curing of the concrete, and thus achieving a higher production. This equipment is

designed to obtain very high production capacity, achieving great versatility.

Along with this equipment, a set of modular lateral moulds has been supplied to produce bridge beams with a maximum length of the beam of 40 meters, allowing the client to cast up to 3 bridge beam units per production cycle. At the same time, this set of lateral moulds has been designed and manufactured to regulate and adjust the height of the beam itself, reaching a maximum of 2,1 meters. The mould also has an upper fast-locking system to ensure maximum stiffness. In addition, these sides can be expanded by purchasing extensions of the structure, universal casting beds and modular lateral moulds to manufacture different prestressed elements.



Industrial building  
aerial view



Battery mould for prestressed joist beam



Pit foundations prestressing systems

These lateral moulds feature a pneumatic vibration system to help concrete compaction. This mentioned pneumatic vibration system will be composed of VSP vibrators of independent action, with a circuit of pipes and fitting, as well as a collector to connect to the compressor of the customer.

With this set of laterals, the client could take part on the different important and big infrastructure and civil work projects which are currently in Romania in general, and in the Transylvanian region, thereby expanding our client's range of products.



Moldtech

## MT20 System The best system for dry cast box culvert



10 box culverts-8 hour shift





*Panels for industrial buildings*

Moldtech has also included in the scope of supply a set of modular lateral moulds for the production of concrete girder. This types of beams are widely used in big industrial and commercial buildings, as the support of two-gable roofings. It is also a big structural element that helps achieving quite long spans and reduce the amount of other structural elements such as columns or other beams, thus forming big concrete structures with fewer elements. They can be manufactured in various lengths and heights. These different dimensions could be achieved with the same set of laterals as long as all beams have the same top flange slope. In this case, the lengths of these beams can vary from 20 to 30 meters, offering great versatility, production capacity and allowing the client to attend to different type of projects. The girder mould could be modulated in length by adding/removing modules between both end parts. These modules are easily assembled and are built to ensure the best continuity and tightness of the mould, thus minimizing possible marks on the prestressed beam.

Other of the equipment included in this project is the self-supporting battery mould to produce T beams for roofs or purlins, being the final equipment to complete the roof of the

mentioned industrial buildings. This equipment is very versatile due to its high level of flexibility, allowing the client to cast different lengths and number of beams alongside its useful 50 linear meters. The mould incorporates a 400Tn prestressing system with stressing heads housed on a self-supporting structure. This equipment consists of a fixed table with longitudinal separators for the manufacture of the beams. Each production line has concity to allow demoulding of parts. Like the rest of the equipment, this self-supporting fixed table to produce T beams for roofs is totally customized as per client's production needs. Therefore, Moldtech could manufacture it in different lengths and with the necessary number of production lines.

The T beams for roof are load-bearing elements that transmit the loads of the slabs to the walls or supporting beams. The end of each of these elements is supported by beams, walls or other structural elements.

To produce the concrete panels that will close these industrial and residential buildings, Moldtech has supplied an amazing tilting table with dimensions of 12 meters length and 3 meters width. However, this tilting table was later extended to 25 meters. This is a very interesting and important extra point considered very positively by all their clients, since any of the moulds or equipment manufactured by Moldtech have the possibility of extending their dimensions according to future needs. This tilting table offers the customer great versatility in terms of the production of different types of panels, allowing to manufacture of a wide range of sizes and even different panel thicknesses, up to 30 centimetres. This thickness can be adjusted by the customer himself in a few minutes through a longitudinal band which is included with the tilting table.

This tilting table has been supplied with an electric vibration system and the suitable frequency converter. This kind of vibration system helps the client to get a very high concrete compaction and the frequency converter delivers power to the electric vibrators and controls the frequency applied to each vibrator, thus achieving a perfect control of concrete compaction and a better quality of the final product.



*Mould for girders*



*Precast girder*



*Tilting table with polished mirror effect*

The tilting of the table is performed via telescopic hydraulic cylinders. These mentioned cylinders are activated using a hydraulic pump unit with electrical control board, being a great help for the final user of this table. These movements could be totally controlled by only one operator. Both, the initial table, and the extension of this one, have been supplied with polished mirror type finish ensuring a very high quality of the product.

As a complement to produce columns for the industrial and residential buildings, a hydraulic mould for columns has been designed, manufactures and installed by Moldtech. It is a fully hydraulic mould, allowing the height regulation of the bottom baseplate through this already mentioned hydraulic system, as well as the opening/closing of the sides of the mould. In this way, the client gets a higher production, since Moldtech considerably reduces the timing for moulding/demoulding. At the same time, this hydraulic mould could also reduce the number of labours required for this same process. The mould is designed with great flexibility, allowing the installation of corbel modules on the 4 sides of the mould and in different positions alongside the mould. This hydraulic mould allows to cast columns with different sections from 60 cm to 1,2 meters width.

This equipment will help the client to optimize the columns section change to the maximum, maintaining the high productivity and manufacturing several columns every production cycle.



*Concrete distribution vehicle Giraffe*

This hydraulic mould for columns features a pneumatic vibration system which helps for a better compaction of the concrete and a better finish surface on the precast column. Meanwhile, this mould is designed and manufactured to accept a potential heating system if required by the client in the future.

For the different procedures of filling the different moulds mentioned in this article, Moldtech has provided a very flexible equipment, the concrete distribution vehicle Giraffe. In this case, this vehicle has been designed and supplied with a capacity of 4m<sup>3</sup>, which will allow the customer to get a faster pouring of the concrete, instead of using the overhead crane. This is always valued as an extra point by our clients, due to the high demand the crane tends to have in any factory. In addition, the Giraffe can be filled directly from the batching plant.

With this new project, one more in their already large list of references in this market, Moldtech consolidates itself as one of the main suppliers of equipment for precast concrete in Romania. ■

#### FURTHER INFORMATION

**Moldtech**  
EQUIPMENT FOR PRECAST CONCRETE PLANTS

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# Rebuilding of infrastructure in Iraq with automated production

## إعادة بناء البنية التحتية في العراق بالإنتاج الآلي

With prefabricated concrete elements many building projects can be realized quicker and safer. With the rising need of affordable housing and new infrastructure, this way of building is making a remarkable impact in Iraq for the better.

باستخدام العناصر الخرسانية الجاهزة، يمكن تحقيق العديد من مشروعات البناء بصورة أسرع وأكثر أمانًا. ومع تزايد الحاجة إلى الإسكان ميسور التكلفة والبنية التحتية الجديدة، فإن طريقة البناء هذه لها تأثير ملحوظ في تحول العراق إلى الأفضل.

### Automation is benefitting the building industry

Fourth Dimension Group has now invested in new machinery and software from Progress Group to modernize their reinforcement production. Now they can be even quicker and more accurate in the production of precast elements for different housing and infrastructural projects. The necessary reinforcement can be produced fully automated with the new mesh welding plant and stirrup bender in order to provide high quality elements such as wall panels, beams & columns, hollow core slabs, girders and planks.

### The future for affordable construction

Is building with precast the future for affordable construction? "Yes.", says Precast Manager Osama Shatat and adds:

"The main advantages of precast technology are quality, speed of construction and a value-for-money product. We all know the proverb "Time is Gold", so the future of building depends on precast." says Mr. Shatat. The use of such technology helps in saving up to 60% of time compared to similar projects using other construction methods and technologies.

Many impactful projects have already been installed with the precast elements from Fourth Dimension:



Video about the report



Al Ghadeer 1 village with 3,200 houses & Al Ghadeer 2 Village with 1,200 houses which was commissioned by the Al-Najaf Al-Ashraf Investment Commission in response to the increasing demand for affordable housing.



Karbala University Hospital is for the benefit of the Ministry of Higher Education and Scientific Research in the holy governorate of Karbala.



Shaab District Overfly Bridge. The bridge has four lanes, and half a kilometer long.



The Lake city project near Baghdad Airport comprises 1,466 villas as well as 26 of Fifteen-floor high rise buildings.

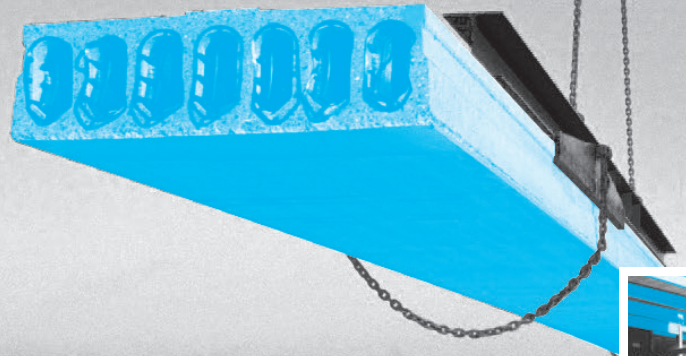
### Automating the reinforcement production

Fourth Dimension Precast invested in a new M-System Blue-Mesh® mesh welding plant and an EBA stirrup bender from Progress Group to obtain their goal of saving time without compromising on quality. The tailor-made mesh for critical architectural and structural design can now be produced fully automated. This improves the production process and makes it possible to deliver within the deadlines. The machinery is easy to operate, the software feature is integrated, and the precision of the performance is remarkable according to the responsible at Fourth Dimension. With the “stabos” software solution integrated in the machinery the collection and evaluation of production data can be done automatically. With the centrally collected data, the productivity and the quality of the plant has been additionally increased.

### High energy efficiency and advanced technology

“We chose Progress Group for our progress, because we noticed that their machinery has high energy efficiency and advanced technology, is cost efficient as well as easy to maintain. Also, the machines do not need a lot of space and have a low staff requirement”, states Mr. Shatat and adds: “I would 100% recommend the machinery and the company. They are always available for us which is a big benefit.”

# Pure flexibility.



## Production of hollow core slabs

### PAUL supplies

- Prestressing installations incl. planning work
- Anchor grips
- Prestressing machinery (single-/multi-stressing jacks)
- Strand pushing and cutting equipment
- Automatic prestressing machines for railway sleepers
- Prestressing equipment for bridge construction (prestressing cables and stay cables)

The experts in Prestressed Concrete Technology.  
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Paul at YouTube



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The M-System BlueMesh is automatically welding the bespoke mesh according to plan with 4 flexible welding heads.



The flexible tailor-made reinforcement for the precast elements can be produced fully automated with the new machinery.

Fourth Dimension Precast is a subsidiary of Fourth Dimension Group and is the leading Baghdad (Iraq) based group focused on building material and construction related industries. Fourth Dimension Precast has been manufacturing precast products since 2002.



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The EBA stirrup bender is providing a just-in-time production of stirrups from coil.

FURTHER INFORMATION



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# SLIM2 Quick Release Vibrator

## The absolute lightweight in its class:

only 18,9kg at 14kN and 6.000 rpm\*  
up to 25% lighter than its competitors

## Superb handling:

easy change among moulds  
e.g. 12 vibrators in 10-15min

## Best price-performance ratio

supreme compaction quality despite low investment  
SL version: lower noise level than comparable vibrators

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**BRECON**  
smart vibration technology

\* BRECON Außenrüttler mit SL Charakteristik(Synchronlauf) erreichen exakt die von der Frequenzsteuerung vorgegebene Drehzahl, z.B. 6000rpm bei 100Hz elektrischer Frequenz. Die Angaben sind bezogen auf Außenrüttler, die die gleichen Charakteristik aufweisen wie BRECON SL-Rüttler. BRECON SL-Rüttler sind in der Geschwindigkeit regelbar. Die SLIM2 Schnellspannhalterung ist auch für BRECON Hochfrequenz und BRECON Normalfrequenz Rüttler einsetzbar.

# Efficiency, versatility and quality

## الكفاءة، وتعدد الاستخدامات والجودة

The global trend towards prefabrication in construction is gaining momentum. The reasons for this development are becoming more and more recognized. The industrialized and modular design saves time and costs while ensuring excellent quality through efficient production in a controlled factory environment. The fact of time and cost saving gets increasingly important, notably - but not exclusively - in mass housing projects. Nowadays, many countries worldwide already discovered prefabrication as construction method to satisfy their enormous need for affordable housing - and there will be more to come.

إن الاتجاه العالمي نحو التصنيع المُسبق في مجال البناء يكتسب مزيدًا من الزخم. فقد أصبحت الأسباب الداعية لهذا التطور معروفة أكثر فأكثر. ويعمل التصميم الصناعي والمعياري على توفير الوقت والتكاليف مع ضمان تقديم جودة ممتازة وذلك من خلال الإنتاج الفعال في بيئات مصانع خاضعة للرقابة. وتزداد أهمية توفير الوقت والتكاليف بمرور الوقت، لا سيما - ولكن ليس حصريًا - في مشاريع الإسكان الجماعي. وفي أيامنا هذه، اكتشفت العديد من البلدان في جميع أنحاء العالم بالفعل التصنيع المُسبق كطريقة للبناء لتلبية احتياجاتها الهائلة من المساكن ميسورة التكلفة - ويخفي لنا المستقبل المزيد.

The modularization of building components can be carried out in various stages; from individual supports and blocks, through wall and ceiling elements, up to finished room cells. Although there are formwork systems for complete monolithic room cells, the cells are often assembled from individual parts, also for reasons of flexibility.

The production of large panels therefore remains the backbone of precast construction. Such panels are also ideal for classic, highly flexible precast construction with all the associated cost and quality advantages. For the prefabrication of named large-format panels, various methods and correspondingly different equipment with known respective advantages and disadvantages are available.

Combining the advantages of horizontal preparation and vertical casting of the elements while eliminating the disadvantages was the goal of B.T. innovation GmbH when developing the Butterfly Battery® Mould. Worldwide, B.T. innovation GmbH is known and appreciated for its innovative and well-thought-out solutions for the improvement of constructions and processes.

The Butterfly Battery Mould as a double formwork platform allows easy and precise insertion and preparation of built-in components (anchors, door and window openings, supply lines, etc.) and reinforcement at one or more workplaces. It then flies folded into the battery formwork and, as an integral component, enables simultaneous production of several elements in the vertical direction.



Patented Butterfly Battery® Mould combines the advantages of horizontal preparation and vertical production



Butterfly formwork® in unfolded position - Horizontal preparation



Shuttering formwork MultiForm with MagFly® AP magnets

To form the elements on the butterfly surface, BT innovation provides reinforced and tailored shuttering solutions. The well-known and trusted MultiForm profiles and MagFly AP magnets of BT innovation are shaped and positioned optimally to bear the significant hydrostatic pressure of fresh concrete at a height of up to four meters.

The horizontal preparation on the butterflies allows laser projectors to be used for accurate marking of the positions of built-in parts, openings and formwork profiles. In addition, control systems with customized handling software contribute to a well-planned and safe work process in the precast plant.

The Butterfly Battery Mould system is used today in Europe and Africa in various automation and complexity levels. The



Control point for unfolding and folding station and laser projectors

end products are high-quality panels with very smooth surfaces on all sides, which are either installed directly in buildings on site or serve as components for prefabricated room modules in the factory. As a technology provider for the precast industry, B.T. innovation GmbH adapts to the individual requirements of customers and develops customized and customer-specific solutions with regard to the targeted budget, capacity, size or scope of delivery. ■

FURTHER INFORMATION



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Smooth formwork surfaces on all five sides, on the edges and on the face of the recesses



Processing of elements smooth on all sides as room module components on the construction site.

# Sustainable semi-precast slabs through a standard-compliant combination with void formers

## ألواح شبه مُسبقة الصب مستدامة من خلال تركيبة متوافقة مع المعايير باستخدام أدوات تشكيل الفراغات

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Dr.-Ing. Karsten Pfeffer, Unidome Deutschland GmbH, Germany

Climate protection is one of the most pressing global issues and requires a rethink at many levels. In this context, the construction and building sector also plays a central role, as it is associated with 38% of global CO<sub>2</sub> emissions. One of the solutions to avoid grey energy and CO<sub>2</sub> emissions and to increase material efficiency is the application of void formers in biaxial concrete slabs. The application of this sustainable technology has so far been mainly present in the in-situ concrete variant, but recently it has been increasingly used in combination with precast or semi-precast solutions. The following article summarizes the current state of the art and, in addition to a brief insight into the research carried out, provides an overview of practical applications in compliance with design codes and homologations.

تعتبر الحماية من المناخ إحدى أكثر القضايا العالمية إلحاحًا وتتطلب إعادة التفكير على مستويات متعددة. وفي هذا السياق، يؤدي قطاع التشييد والبناء أيضًا دورًا مركزيًا، نظرًا لأنه يرتبط بها فهو مصدر 38% من انبعاثات ثاني أكسيد الكربون العالمية. ويكمن أحد الحلول الممكنة لتجنب الطاقة الرمادية وانبعاثات ثاني أكسيد الكربون وزيادة كفاءة المواد في استخدام أدوات تشكيل الفراغات في الألواح الخرسانية ثنائية المحور. فقد كان استخدام هذه التكنولوجيا المستدامة موجود أساسًا حتى الآن في خيار الخرسانة داخل الموقع، ولكن مؤخرًا بدأ استخدامه بشكل متزايد مع حلول الخرسانة الجاهزة أو شبه الجاهزة. تلخص المقالة التالية آخر التطورات الحاصلة، بالإضافة إلى نظرة ثاقبة مختصرة بخصوص البحث الذي تم إجراؤه، وتقدم أيضًا نظرة عامة عن الاستخدامات العملية التي تتوافق مع رموز التصميم والموافقات.

Sustainable and resource-saving construction is the dominant topic in the construction industry at the present time. The urgently needed reduction in global CO<sub>2</sub> emissions can only succeed if the CO<sub>2</sub> emissions associated with the construction of buildings are also significantly reduced. Building owners, planners and contractors are therefore increasingly taking these aspects into account in their actions. At the same

time, concrete remains the most widely used building material, so that in concrete construction in particular, ways must be found to build in a material-saving and resource-efficient manner. Since the largest quantities of concrete in any building are used in the slabs, these components are the most important starting point here.



Fig. 1: Void former element Unidome XS and installed elements in a reinforced concrete slab



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hollow-core slabs made of reinforced, prestressed concrete and the realistic determination of constrained internal forces. [andrej.albert@hs-bochum.de](mailto:andrej.albert@hs-bochum.de)



■ Dr.-Ing. Karsten Pfeffer studied civil engineering at the Technical University of Darmstadt and graduated in 1996. He also completed his doctorate in this subject in 2001 at the Technical University of Darmstadt on the topic of biaxial hollow-core slabs made of reinforced, prestressed concrete. He is an inventor and one of the co-founders of Cobiax, where he served as CEO until 2019. In 2019, he founded the Unidome company, where he

is managing partner. His development activities form the basis for the international application of the design with biaxial prestressed hollow-core slabs. [pfeffer.k@unidome.de](mailto:pfeffer.k@unidome.de)

Against the background described above, the importance of biaxial voided slabs has increased rapidly in recent years. In this construction method, void formers displace the concrete in those areas of a reinforced concrete slab where it makes only a minor contribution to the load-bearing capacity. The arrangement of the void formers reduces the dead weight in the voided area by about 30%, while the flexural stiffness is reduced by only about 10%. This, in turn, allows the slab thickness to be reduced and/or the span of the slab to be increased compared to a solid slab. In addition, the lighter slab structures also have a favorable effect on the continuing components of the vertical load transfer. Due to the lower load, these can be reduced in size - especially if biaxial voided slabs are used on several floors - and thus enable additional material savings. Biaxial voided slabs thus represent a very material-efficient and at the same time economical construction method!

State-of-the-art void formers for the construction of biaxial voided slabs are produced and distributed by the company Unidome. For a simplified installation, six void formers are combined into modules in this system. The coupling of the individual void formers is done with the help of two reinforcement bars  $\varnothing = 6 \text{ mm}$  (Fig. 1 left). The void formers are then placed between the lower and upper reinforcement of a reinforced concrete slab (Fig. 1 right).

### Research results on the load-bearing behavior of biaxial voided slabs

With the usual dimensions of a biaxial voided slab, neither the bending compression zone nor the bending tension zone are weakened by the voids. Thus, the flexural capacity of a biaxial voided slab corresponds well with the flexural capacity of a solid slab of the same thickness. The shear strength of slab areas with voids, on the other hand, is lower than that of solid slabs. In addition, the magnitude of concentrated loads acting directly above a void must be limited in order to avoid local punching shear failure. Numerous research projects in recent years have therefore been devoted to these two topics - the investigation of the shear strength and the local punching shear capacity of biaxial voided slabs.

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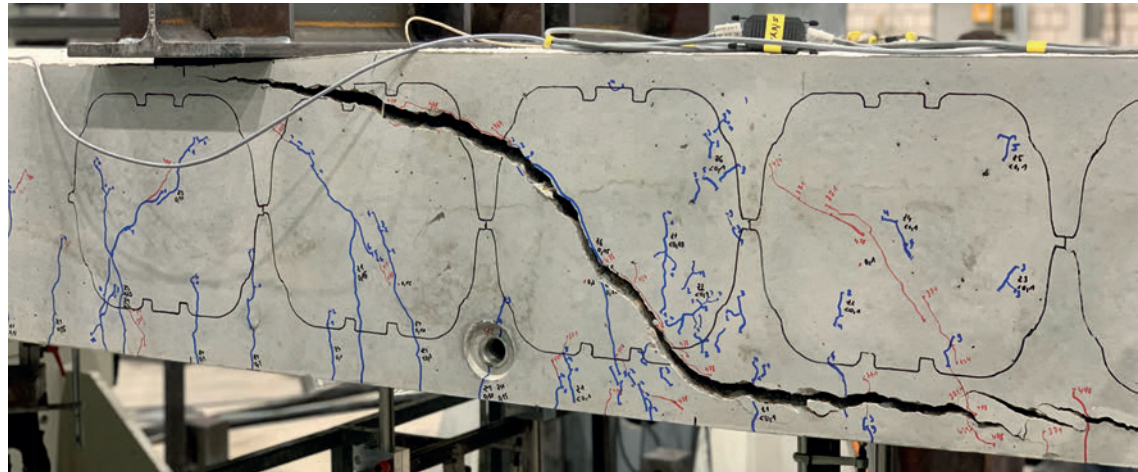
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Fig. 2: Test of shear strength on a reinforced concrete slab of thickness  $h=40$  cm with void formers Unidome XS 260 (290)



The shear strength of biaxial voided slabs has been extensively researched since 1998 [1][2][3]. For the approval of the most modern system Unidome XS, in addition to a medium slab thickness, the thinnest and the thickest slabs respectively, which are regulated in the German homologation, were tested in 3-point bending tests. In the slabs with a thickness of  $h=18$  cm, the smallest void formers (type Unidome XS 60 (90) with a cavity height of 6 cm) were installed, and in the slabs with a slab thickness of  $h=40$  cm, the largest void formers (type Unidome XS 260 (290) with a cavity height of 26 cm) were installed. To cover the worst case in terms of strength, a concrete with high compressive strength (concrete strength class C45/50) was chosen. Fig. 2 shows a test slab of thickness  $h=40$  cm immediately after shear failure.

Parallel to the tests on reinforced concrete slabs with void formers, tests were carried out on identical reinforced concrete slabs without void formers. In this way, reduction factors were determined with which the shear strength of voided slabs can be determined in a very simple way on the basis of the shear strength of a corresponding solid slab according to [4] (cf. equation 1). The reduction factors  $f_{UNIDOME}$  are given in the respective homologations such as in [5] and [6].

$$V_{Rd,c,UNIDOME} = f_{UNIDOME} \cdot V_{Rd,c,massiv}$$

- $V_{Rd,c,UNIDOME}$  Shear strength of a reinforced concrete slab with Unidome void formers
- $f_{UNIDOME}$  Reduction factor according to the respective homologation
- $V_{Rd,c,massiv}$  Shear strength of a solid slab according to EC 2-1-1

Numerous tests were also carried out to check the safety against local punching. They were used to determine how high concentrated loads acting directly above the void formers may be.

### Design and execution of biaxial voided slabs

Due to the reduced shear strength of slab areas with void formers compared to solid areas, the void formers are only placed in those areas of a slab where the shear force is lower than the shear strength of the voided slab (Fig. 3).

In the areas where void formers are arranged, the dead weight and the bending stiffness of the slab are reduced. The reduction of the dead weight can be taken into account in the structural design of the slab, for example, by applying

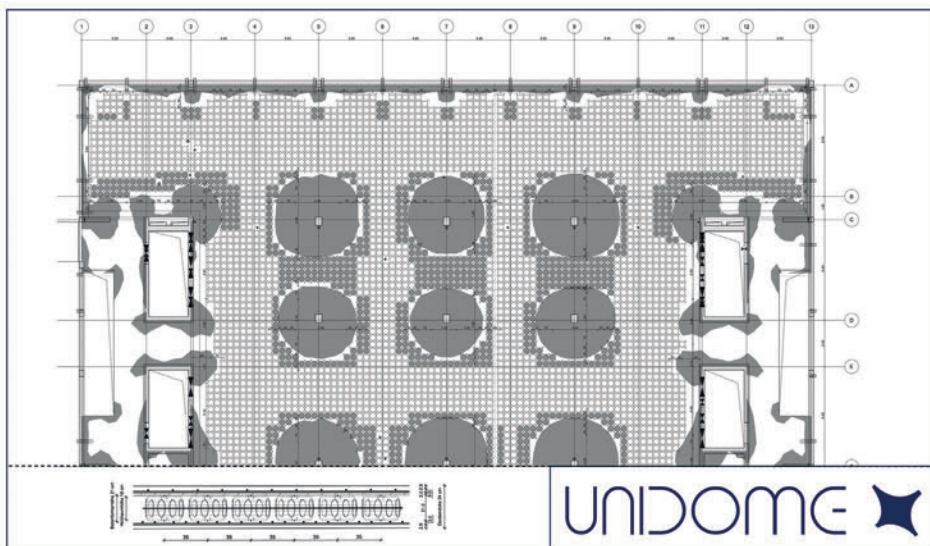


Fig. 3: Installation plan - arrangement of void formers in a common structural slab



Fig. 4: Semi-precaster slab with void formers placed on top

a lifting permanent load, while the reduction of the bending stiffness can be taken into account, for example, by reducing the modulus of elasticity in the respective area.

### Biaxial voided slabs with semi-precaster elements

Biaxial voided slabs are also being used more and more frequently in combination with semi-precaster slabs. In this way, the advantages of the construction method with semi-precaster slabs are combined with those of voided slabs. The void former modules are placed on the semi-precaster slabs (Fig. 4). When designing and constructing biaxial voided slabs in combination with semi-precaster slabs, some additional regulations must be observed that are defined in the corresponding homologations. Thus, it must be ensured that a lattice girder is always placed between two rows of void formers. In addition, all lattice girders must be high enough to reach the upper reinforcement layer of the voided slab. Furthermore, a minimum distance between the void formers and the lattice girders must be provided to maintain the concrete cover. The clear distance between two void formers should be at least 10 cm so that the lattice girders can be installed with the necessary minimum clearance. To ensure proper compaction of the fresh concrete also below the void formers, a minimum distance between the void formers and the surface of the semi-precaster slab must be maintained in accordance with the respective homologation. The consistency of the fresh concrete must correspond to the upper range of class "soft" or to class "very soft" and the maximum aggregate size should not exceed 16 mm.

The arrangement of the transverse reinforcement on top of the semi-precaster element (below the void formers) allows the bars to be arranged at a distance from each other that does not exceed the maximum permissible value according to the respective design code.

On the one hand, the installed lattice girders serve to ensure that the slabs already have a sufficiently high bending stiffness during construction so that they can be safely transported, lifted and installed. On the other hand, they assume the function of bond reinforcement for the joint that is created between the precast element and the in-situ concrete. When designing the required cross-section of the bond reinforcement, a reduced bond area must be taken into account because of the hollow bodies positioned on the slab. A conservative approach which is used in the German homologation is to assume a remaining area of 30%. The upper surface of the semi-precaster slabs can be smooth or rough and the corresponding value can be applied in the calculation. The arrangement of a minimum shear reinforcement, which is required for the in-situ concrete solution in accordance with the German homologation, may be dispensed within this design variant, as the lattice girders take over this function. The upper reinforcement must be fixed at regular intervals to the nodes of the lattice girders to reliably prevent the void formers from floating upwards.

### Practical application

If the design of a Unidome slab in combination with semi-precaster elements is considered, care must already be taken in the design stage to ensure that the load reduction is applied according to the intended configuration of the slab structure. When selecting the size of the void formers, the required distance between the void formers and the semi-precaster slab must be taken into account. Furthermore, the required distance in the transverse direction is greater than for the in-situ concrete variant due to the arrangement of the lattice girders. If the manufacturer's plant is fixed, an optimum slab layout and void former arrangement can be carried out with the specified production dimensions, taking into account the speci-

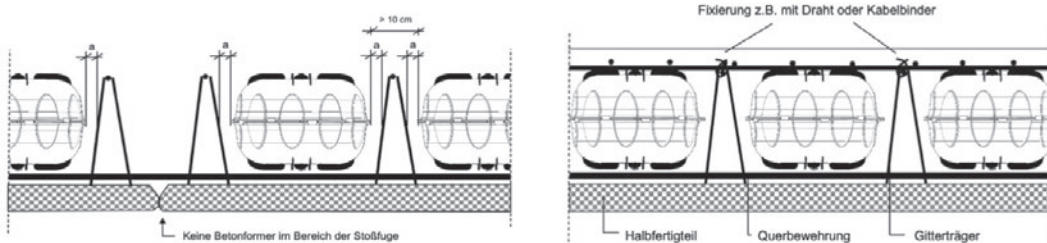


Fig. 5: Illustration of a semi-precaster slab with Unidome void former elements

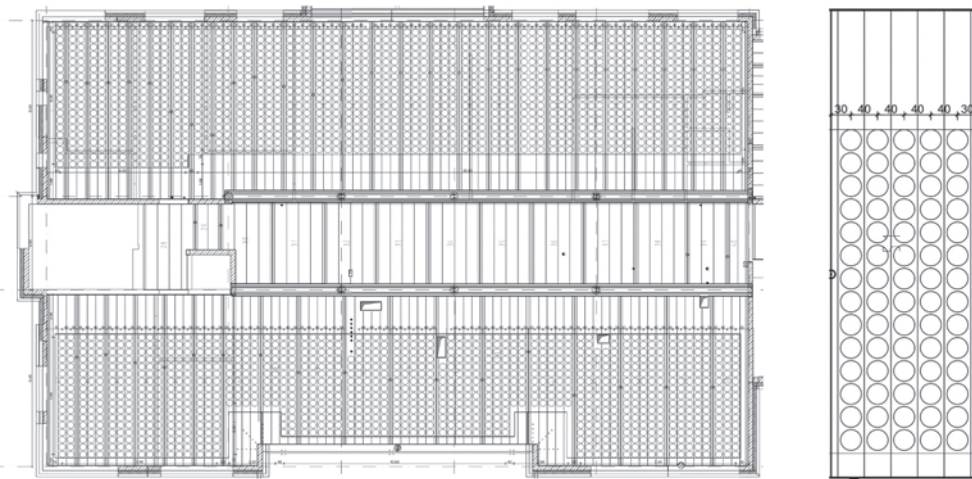


Fig. 6: Installation plan with slab layout and void former arrangement (left) and single slab (right)

cations from the structural design. During production, special attention must be paid to the exact arrangement of the lattice girders so that the void formers can later be inserted between the lattice girders by the contractor in accordance with regulations. On the construction site, the semi-precast slabs are then installed first. Afterwards the transverse reinforcement is placed on the semi-precast slabs. The void formers are then positioned between the lattice girders on the transverse reinforcement in accordance with a special installation plan (Fig. 6). Once the upper reinforcement layer has been installed and fixed to the lattice girders, the void formers can be fixed to the upper reinforcement with rebar tie wire so that concreting can take place without uncontrolled floating of the void formers.

**Advantages of the construction method**

The use of semi-precast concrete slabs is a common construction method in many countries. Compared to in-situ concrete construction, this method leads to a higher degree of prefabrication and can contribute to a noticeable acceleration of the construction process, as time-consuming formwork work on the construction site is not required. In addition, part of the reinforcement work can already be carried out in the precast plant. On site, only the transverse reinforcement as a connec-

tion between the individual precast elements and the upper reinforcement have to be installed. The position of the void formers in the transverse direction is already predefined by the precisely planned arrangement of the lattice girders and allows these elements to be installed quickly. In this construction method, the lattice girders also serve as spacers for the upper reinforcement layer. In contrast to the in-situ concrete solution with void formers, the semi-precast method allows the concrete to be poured on site in one single work step. Among many other advantages, the environmentally friendly construction method described here offers the possibility of saving up to 30% of concrete and thus avoiding some of the climate-damaging effects of concrete construction. For the production of the Unidome void formers, 100 % recycled plastic is used. In case of a later demolition of the building, almost 100 % of the plastic can be separated from the remaining material without any additional effort and reused [7].

**Summary and future directions**

If the climate targets bindingly agreed by numerous governments are to be achieved, a blatant rethink is also required in the construction industry. In concrete construction in particular, there is still great potential for optimization with regard

Fig. 7: Installed semi-precast elements with transverse reinforcement and Unidome void formers



to resource-efficient and climate-friendly construction. To this end, numerous approaches are currently being pursued, such as optimization of cement production or the use of recycled aggregates. However, the most effective measure that can be implemented immediately is to use optimized shaping systems to build with as little material as possible.

The effectiveness of this approach has been impressively demonstrated in recent years by the use of the innovative and sustainable technology for biaxial voided slabs. The players of the company Unidome are the pioneers and experts of this type of construction. While the technology has so far mostly been used in cast-in-place concrete construction, it can now also be used in a simple manner, in compliance with standards and homologations, in precast construction and in particular in combination with semi-precast slabs.

New products that enable further steps towards sustainable construction using automation, digitalization and sensible prefabrication are currently being developed by the company Unidome. The aim here - to bring material-efficient construction with concrete into widespread use and thus to fully exploit the potential for reducing CO<sub>2</sub> emissions. ■

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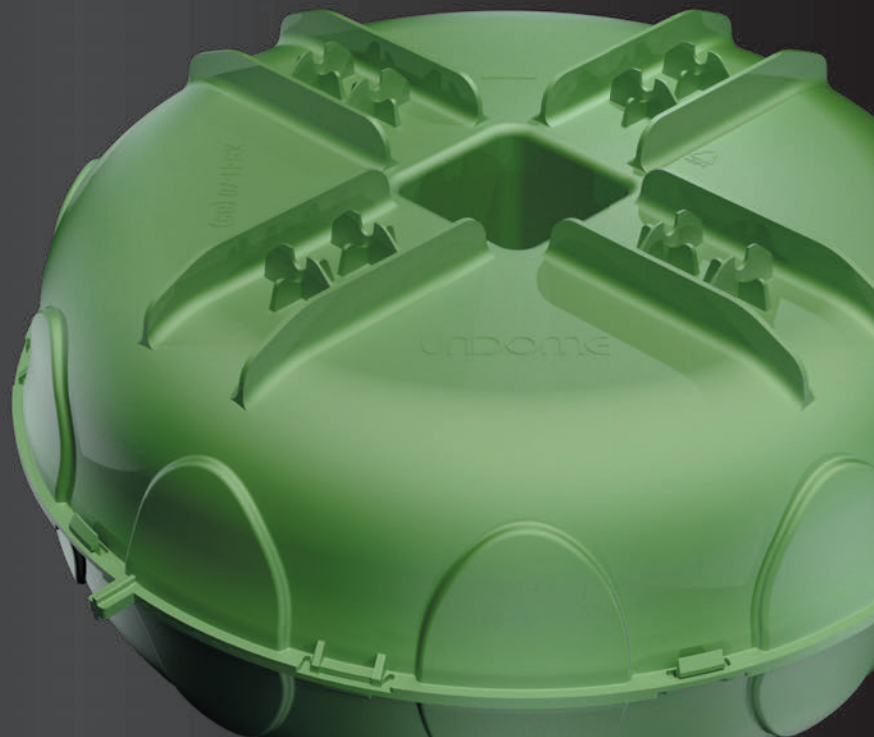
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# Different types of 3D moulds for precast manufacturers around the world

## أنواع مختلفة من القوالب ثلاثية الأبعاد لمصنعي الخرسانة الجاهزة في جميع أنحاء العالم

As one of Europe's leading mould manufacturers, Construx conceived over the years a full range of state-of-the-art 3D moulds. Either with a fixed geometry, adjustable or even fully automated, 3D moulds are amongst the most complex moulds due to their particular design, special features and technical specifications. Recently, Construx supplied several different types of 3D moulds to a number of precast manufacturers all over the world.

بتصنيفها كإحدى شركات تصنيع القوالب الرائدة في أوروبا، ابتكرت شركة Construx على مر السنين مجموعة كاملة من القوالب ثلاثية الأبعاد الحديثة. تعد القوالب ثلاثية الأبعاد من أكثر القوالب تعقيدًا نظرًا لتصميمها الخاص، وميزاتها ومواصفاتها الفنية الخاصة، وهذا سواء كانت تُصنَّع باستخدام هندسة ثابتة أو قابلة للضبط أو آلية بالكامل. وحديثًا، قدمت شركة Construx عدة أنواع مختلفة من القوالب ثلاثية الأبعاد لعدد من الشركات المصنِّعة للخرسانة الجاهزة في جميع أنحاء العالم.

### Poland: Fully adjustable substation mould

These substations are poured upside-down and turned 180° after demoulding. This fully hydraulically and electrically controlled substation mould is conceived to manufacture 4 different lengths and 2 different widths with following possible dimensions:

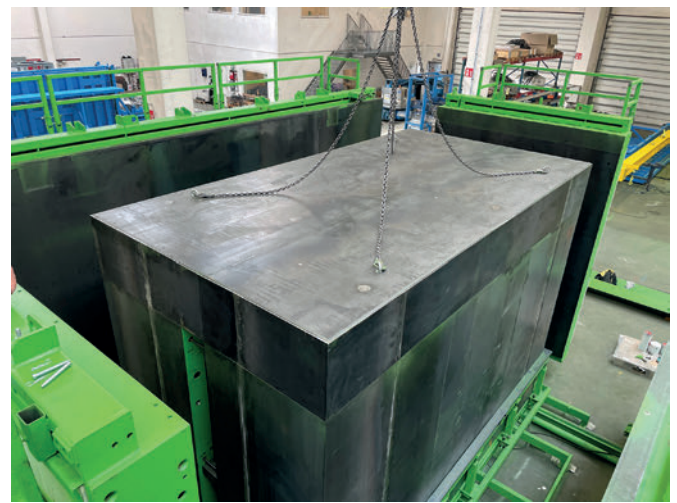
- Inside length adjustable: 3150mm, 3800mm, 4200mm and 4700mm
- Inside width adjustable: 2600mm and 3000mm
- Inside height steplessly adjustable from 2400mm to 3000mm,
- Wall thickness adjustable: 90mm and 120mm



Fully adjustable substation mould, at commissioning in one of the Construx production facilities, just before leaving for Poland

Construx also provided 2 different top parts for the inside mould, to be able to make elements with sharp edges between floor and walls or with large chamfers at both ends, a typical feature to accommodate underground duct connections.

The outside mould has hydraulically movable panels. Vibrating the elements is done with high frequency vibrators. The inside mould has a fixed part and several movable parts, according to the above modularity. The intermediate parts can be fit in individually or together. When demoulding, first the inside corners are pulled down hydraulically after which the wall panels are also pulled down in the same way, this leaves an 8mm opening on all sides.



Inside of the fully adjustable substation mould



PLC controlled fully hydraulically, and electrically adjustable mould being tested in one of the Construx production facilities

**Germany: PLC controlled fully hydraulically and electrically adjustable mould**

As for the mould above, these substations are also poured upside-down. After demoulding they are turned 180° on a 65T capacity double tilting station before they are transported by an overhead crane to the finishing bay. This fully hydraulically and electrically controlled substation mould is conceived to manufacture 8 different lengths and 3 different widths with following possible dimensions:

- Inside length adjustable from 2180mm to 6380mm, with 600mm increments
- Inside width 2300mm, 2500mm and 3780mm
- Inside height from 2500mm to 3600mm, steplessly adjustable
- Wall thickness adjustable from 100mm to 200mm, with 20mm increments
- Floor thickness from 120mm to 300mm, steplessly adjustable

The outside mould has 3 hydraulically movable panels, the fourth panel can be opened electrically over a distance of 3000mm. Vibrating the elements is done with 30 high frequency vibrators. The inside mould has a fixed part and a movable part with modular intermediate parts of 600mm, 1200mm and 2400mm, which can be fit in individually or together. The width of each module and of the complete inside mould can be adjusted with one single movement by means of electric spindles. The intermediate parts can be prepared on beforehand in order to speed up the adjustment of the mould. When demoulding, first the inside corners are pulled down hydraulically after which the wall panels are pulled down in the same way. All hydraulic rams and electric spindles are controlled by means of a PLC with touchpad which also shows the workflow graphics.



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For manipulating the substations, Construx conceived a 180° turning station with a 65T capacity. This device consists of a set of 2 combined 90° tilting stations with a 6m transport system in between, so the customer can either tilt the elements 90° or turn them 180°. It also has a 14m long transverse movement for transporting the substations to the finishing bay.

### Belgium: Fully automated and hydraulically operated substation mould

Because the main walls of the substations are straight and only the basement walls, both inside and outside, are tapered, the demoulding needs to be done hydraulically. The mould has 2 hydraulically shrinkable inner cores and 4 hydraulically movable outside panels. Not only shrinking and moving are hydraulic, but also securing the outside panels is done with a hydraulic wedge system. Before the outside panels can be opened completely, they are slightly pushed backwards by means of a hydraulically operated eccentric device. The actual demoulding of the element is initiated by pushing the bases up and consequently lifting the element out of the mould by means of 6 perfectly synchronized hydraulic rams and 6 air vents. Construx provided the complete mould with electronic valves, sensors and a control panel, thus controlling all movements and securing the right sequence of movements, which resulted in a fool-proof system.

List of sensors:

- On every corner joint: check wedge open or wedge closed
- On every wall: check wall open or not
- On every corner of the shrinking core: check core completely out or core completely in
- On the push-up system: check system out or system in / bottom in or bottom out

Sequence of demoulding operations:

- Pulling wedges on the outside corners
- Pushing walls slightly open
- Opening walls completely
- Shrinking of inner core
- Pushing up the concrete element

Sequence of closing operations:

- Expansion of inner core
- Closing outside panels (pushers retracted)
- Securing the outside panels by closing the wedge connections

An audio signal and a flashing light indicate when the mould is in operation.

The elements are poured upside-down with self-compacting concrete. To facilitate the turning of the element, Construx supplied a special frame connecting the mould onto the customers' turning device. All the outside panels have working platforms, one of which is equipped with a stair and the 3 others have access ladders. Construx also supplied a roof mould.

Dimensions of the substation:

- Length 3525mm x Width 2380mm x Height 2780mm
- Upper part wall thickness: 80mm
- Inside and outside basement walls with various tapers

### The Netherlands: Hydraulically operated adjustable substation mould with complex geometry and architectural outside pattern

This mould stands out by the special feature on the outside panels. The continuous recesses with a wavy pattern and the large bottom rebate, surrounding the top of the mould, cre-



Fully automated and hydraulically operated substation mould for a Belgian customer



Test pour demoulding of a substation in a Construx production facility, before leaving for The Netherlands

ate an extra difficulty for demoulding the elements. Construx designed the mould suitable for 2 different element lengths, to allow for this adjustability, one of the outside panels can be set at 2 different locations and one of the inside cores can be larger or smaller by adding or removing a large insert. The mould has 1 inner core that is pulled down hydraulically, 2 hydraulically shrinkable inner cores and 4 hydraulically movable outside panels. Before the outside panels can be opened completely, they are slightly pushed backwards by means of a hydraulically operated eccentric device. The actual demoulding of the element is initiated by pushing the bases up and consequently lifting the element out of the mould by means of several perfectly synchronized hydraulic rams and air vents. All the outside panels have working platforms, 2 of which are equipped with an access ladder. The elements are poured upside-down with self-compacting concrete. To facilitate the turning of the element, Construx supplied a hydraulic turning device which is adjustable, not only for the 2 actual substation types, but also for future elements with other dimensions. Construx also supplied adjustable basement and roof moulds.

Dimensions of the substations:

- Length 2449mm and 3449mm x Width 1324mm x Height 2190mm
- Inside and outside walls with various tapers

**Australia: Large series of quadruple and double prison cell moulds going to Grafton**

Construx supplied a series of moulds for the largest prison in Australia, the Clarence Correctional Centre which accommodates 1,700 beds. This new correctional facility is located near Grafton, New South Wales, Australia. The Northern Pathways consortium, comprising of Serco, John Laing, John Holland and Macquarie Capital completed the construction by the end of 2020. As the civil works subcontractor for John Holland, Civmec Construction & Engineering was responsible for manufacturing the prison cells. Seen there was no precast company in the area which was capable to supply such a large number of complex cells, Civmec installed a complete precast yard on the building site and ordered the cell moulds from Construx. Construx was appointed, not only to design and manufacture but also to ship, install and commission the moulds. Before shipment, the moulds were set up, tested and pre-commissioned in house. The scope of works included: 1n°



Large series of quadruple and double prison cell moulds in Grafton, Australia

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*Demoulding of a quadruple prison cell unit in Grafton, Australia*



*Commissioning at Construx of a quadruple cell mould before going to Melbourne, Australia*

Quad-Single Ensuite mould (QSE) and 2n° Double-Double Ensuite moulds (DDE). The QSE mould was not only used to pour 4 interconnected cells but also to pour single, double and triple units, with the possibility of pouring insulated or non-insulated outside walls. The same idea applied to the DDE moulds, making these moulds extremely flexible and multi-functional. The moulds allowed to pour outside walls, inside walls, roof and balcony at the same time. A considerable part of the order was to design and supply all forms for window and door openings, box-outs for the smaller cavities, bases with rubber sealants on both sides, adjustable stop-ends and even the toilet-base recess formers.

All three moulds were designed and manufactured according to current standards, and they included hydraulically shrinkable and retractable inner cores and hydraulically moveable outside panels. To comply with local safety standards, the moulds had full steel working platforms with access stairs on the outside forms. Although the use of self-compacting concrete was assured from the start, Civmec insisted on having a limited number of electrical vibrators to be able to instigate the pouring process at all times. To guarantee a next day easy demoulding Construx provided accelerated curing by means of fans.

### **Australia: Quadruple cell mould going to Melbourne**

Another Australian prison of which the cells were prefabricated with a Construx mould was the Chisholm Road Prison in Lara, Victoria. This maximum-security prison which was commissioned late 2022, accommodates 1,248 prisoners, and provides capacity for Victoria's future growing prison population. John Holland, as Managing Contractor, subcontracted the production of the precast cells to Westkon, one of Australia's major precast manufacturers. Construx supplied a 'full option' quadruple prison cell mould to their Melton

yard in Cobblebank, Victoria. The Construx scope of works included design, manufacturing, pre-commissioning, supply, and commissioning of one quadruple cell mould in which the customer could cast a 4-room cell or a 2-room cell, complete with balcony. The assembly and installation of the mould was carried out by Westkon because no Construx technicians were allowed to enter the country due to the Covid-19 restrictions. To facilitate the installation, Construx provided detailed assembly and operation instructions as well as several series of photographs and videos of the assembly and pre-commissioning in the Construx facilities prior to the shipping. The multifunctional mould was made adjustable, to be able to cast any different wall thicknesses. The cell mould included following items: base frame, hydraulically shrinkable inner cores, hydraulically moveable outside panels, bases with rubber sealants on both sides and full steel working platforms with access ladders. Construx also provided supports and fixation systems for door and window frames, power points boxes, light switch boxes and light fittings, as well as adjustable box-outs with magnets for all other required cavities. Seen the mould was going to be used outside, Construx included steel pipes with outlets on the outside and the inside of the mould for heating and insulation on the outside mould. All hydraulic rams, electrical vibrators and electrical cabinets were fully connected and pre-installed, to reduce the installation time as much as possible.

### **Australia: Fully adjustable box mould going to Adelaide**

This fully adjustable mould is conceived to manufacture elements with 6 different lengths and 3 different widths with following possible dimensions:

- Inside length adjustable: from 2500mm up to 5000mm, with 500mm increments



Fully adjustable box mould, ready for commissioning before leaving for Adelaide, Australia

- Inside width adjustable: 2200mm, 2500mm and 3800mm
- Height: steplessly adjustable from 1350mm to 2600mm
- Wall thickness adjustable: 150mm, 175mm, 200mm and 250mm

The outside panels have wheels and sit on rails, as they can be opened and closed by hand using a gear drive. The long outside panels have a 1500mm stroke: 700mm demoulding + 800mm adjustability. The short outside panels have a 1750mm stroke: 700mm demoulding + 1250mm adjustability. The two long lateral outside panels are 6000mm wide and the two short transverse outside panels are made of a main 2200mm wide panel plus two add-on parts, one of 300mm and another of 1600mm. The inside mould has shrinkable corner panels with interchangeable intermediate panels. Steel bases of 4 different widths sit on height adjusters. Obviously, there are no tie-bars through the concrete elements, only over the top and underneath.

### USA: Fully automated mono-box mould going to Hawaii

The system is suitable to make mono-boxes. These elements come with a fixed width and different lengths, forming a minimum size box of 6' x 6' and a maximum size of 6' x 20':

- Inside width: 6'
- Inside length: 6' to 20' in steps 1'
- Wall thickness: 8", 10" and 12"

The idea of the mould is to start with a stable chassis with integrated rails on which all components can roll into position. Outside panels are also rolling on this frame and height adjusters fit on the chassis. The fixed part of the core consists of a fixed end segment made up of two hydraulic shrinkable



Fully automated mono-box mould, ready for shipment to Hawaii, USA

corners and a fixed roof plate. A second end segment sits on wheels and is longitudinally movable on the frame. In this way the core can be extended with intermediate segments. Both connected end segments form the minimum box size: 6' x 6'. When adding infill segments in between the end segments, any other internal length can be achieved. The 2 transverse outside panels of 6' long have 4 extra extensions of 2" and 4 extra extensions of 4" on both sides, to make the 3 different thicknesses. These 2 transverse panels roll between the 2 longitudinal panels of 22'. The panels can be connected to make all combinations of wall thicknesses and core dimensions. All panels can open 800mm for demoulding and easy access to put rebar and box-outs. Opening and closing the outside panels is done hydraulically. All infill segments and the movable end segments are equipped with a hydraulic lock. This hydraulic locking device consists of 3 individual pins which each have a hydraulic cylinder to activate them. The hydraulic lock avoids workers having to go inside the core when assembling it. All outside panels are equipped with safety floors and access ladders, and Construx also supplied an extra working platform between outside panels and inside core. ■

### FURTHER INFORMATION



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# Japanese contractor buys second concrete batching plant for Madagascar port development

## مقاول ياباني يشتري مصنع خلط الخرسانة الثاني لتطوير ميناء مدغشقر

One of Lintec & Linnhoff's long-time customers was so impressed by the performance of the Eurotec ECO60 concrete batching plant that they ordered a second model to support its work on the Toamasina Port Development Project (Phase 2) in Madagascar.

انتهز أحد عملاء شركة Lintec & Linnhoff منذ فترة طويلة بأداء مصنع خلط الخرسانة Eurotec ECO60 لدرجة أنه طلب إنشاء نموذج ثانٍ له لدعم عمله في مشروع تطوير ميناء تواماسينا (المرحلة 2) في مدغشقر.

The Japanese contractor was already familiar with the ECO60 as they have been using the same model before. When they needed a new plant for a port extension project, it was an easy choice for them to purchase the same model. The decision to buy the second plant was made after being convinced of its quality and reliability, as well as enjoying the superb level of aftersales support of the Eurotec team.

"This customer always has a need for high productivity and reliable plant, which is why they took advantage of the ECO60 plant's performance and reliability. In order to meet the new project's requirements for more complex concrete mix designs, they upgraded that first ECO60 model from three aggregate bins to five bins," explains R. Sakthi, CEO,

Lintec & Linnhoff Concrete. "So after they witnessed it could deliver the high performance they wanted, they ordered another ECO60 plant with five aggregate bins."

The ECO60's modularised structure provides fast installation and easy maintenance. It started producing a consistent mix of concrete volume for a range of tasks on the Toamasina Port Development Project.

The new quay and container storage area, already the largest commercial port in Madagascar, is expected to increase Toamasina's port handling capacity. On top of that, the deepened berths allow more and larger cargo and container ships to dock.



This Eurotec ECO60 Concrete Batching Plant was used by a Japanese contractor for the redevelopment of the Toamasina Port project.



The Eurotec ECO60 can produce up to 60 m<sup>3</sup>/hour of ready-mix concrete in batches of 1 m<sup>3</sup>.



**Eurotec ECO60**

The stationary Eurotec ECO60 provides a reliable solution for customers who demand an economical concrete batching plant with high-quality concrete production. The customer can also customise the number of aggregate bins (3-6 inline bins) according to the project's concrete mix requirements.

The model produces up to 60 m<sup>3</sup>/hour of ready-mix concrete in batches of 1 m<sup>3</sup>. The consistency of the mix is ensured by the weighing and batching systems that are metered using load cells. This is managed with Eurotec's own in-house ECS process-control system software that runs on Windows OS for fully automatic operations.

A twin-shaft mixer, 100% manufactured in Italy, supports high-volume production and rigorous mixing intensity. Its robust steel structure and thick interior abrasion-proof linings ensure long-lasting durability. Located at 90° intervals, the double-mixing spiral paddle structure delivers greater abrasion-resistance and high-performance production than conventional mixers. This is a valuable advantage when blending materials with particle sizes from 120 to 150 mm.

The long-running Toamasina Port redevelopment program has already witnessed major improvements, with port handling capacity rising from just 60 tons to 2,500 tons per day. In addition, bottlenecks that would see full containers languishing for an average of 20 days has been eliminated.

Toamasina now handles 90% of Madagascar's container traffic and more than 80% of all the country's trade traffic, making it a leading regional hub with connections to Africa, Asia, Europe and the Gulf states. The latest phase of the project is set to make a significant contribution to Madagascar's economic development. It has already accelerated other new projects across the country, leading to increased investment in mining and cement production. ■

FURTHER INFORMATION



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